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For any updates of this book, please refer to the subject homepage:


For mathematics problems consultation, please email to the following address:

[tkl.mathematics@gmail.com](mailto:tkl.mathematics@gmail.com)

For Maths Corner Exercise, please obtain from the cabinet outside Room 309
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Mark: ________
10.1A Angles at a Point

The sum of angles at a point is 360°.

\[ a + b + c + d = 360° \]

[Reference: \( \angle s \) at a pt.]

**Example 1**

Find \( x \) in the figure.

\[
\begin{align*}
40° + x + 200° &= 360° \\
x &= 360° - 40° - 200° \\
&= 120°
\end{align*}
\]

**Instant Drill 1**

Find \( y \) in the figure.

\[
\begin{align*}
y + 130° + 70° &= 360° \\
y &= 360° - 130° - 70° \\
&= 160°
\end{align*}
\]

1. Find \( x \) in the figure.

2. Find \( x \) in the figure.

3. Find \( x \) in the figure.

4. Find \( x \) in the figure.

\( \text{Ex 10A 1–8} \)
10.1B  Adjacent Angles on a Straight Line

The sum of adjacent angles on a straight line is 180°.

i.e. In the figure, if POR is a straight line, then \( a + b = 180° \).

[Reference: adj. \( \angle s \) on st. line]

Example 2

In the figure, AOB is a straight line. Find \( x \).

\[
\begin{align*}
x + 110° &= 180° \\
x &= 180° - 110° \\
&= 70°
\end{align*}
\]

Instant Drill 2

In the figure, XOZ is a straight line. Find \( a \).

\[
\begin{align*}
(\quad) + (\quad) &= 180° \quad \text{adj. } \angle s \text{ on st. line}
\end{align*}
\]

5. In the figure, AOB is a straight line. Find \( x \).

6. In the figure, DOE is a straight line. Find \( y \).

When three or more adjacent angles lie on a straight line, their sum is still 180°.

7. In the figure, KOL is a straight line. Find \( z \).

8. In the figure, POQ is a straight line. Find \( x \).

\( \Theta \) Ex 10A 9–16
10.1C Vertically Opposite Angles

When two straight lines intersect, the vertically opposite angles formed are equal.
i.e. In the figure,
if \(POQ\) and \(ROS\) are straight lines,
then \(a = b\) and \(c = d\).
\[\text{Reference: vert. opp. } \angle s\]

Example 3
In the figure, two straight lines intersect at a point. Find \(x\) and \(y\).

\[
\begin{align*}
\text{Sol} \quad x &= 120^\circ \\
y &= 60^\circ
\end{align*}
\]

Example 3

<table>
<thead>
<tr>
<th>In the figure, two straight lines intersect at a point. Find (a) and (b).</th>
</tr>
</thead>
</table>
| \[
\begin{align*}
\text{Sol} \quad a &= \quad \text{\textit{vert. opp. } \angle s} \\
b + ( ) &= ( ) \quad \text{\textit{vert. opp. } \angle s} \\
b &=
\end{align*}
\] |}

9. In the figure, straight lines \(PQ\) and \(RS\) intersect at \(O\). Find \(x\).

10. In the figure, straight lines \(AB\) and \(CD\) intersect at \(O\). Find \(x\).

11. In the figure, straight lines \(PQ\) and \(RS\) intersect at \(O\). Find \(a\) and \(b\).

12. In the figure, straight lines \(AB\) and \(CD\) intersect at \(O\). Find \(x\) and \(y\).
13. In the figure, straight lines $AB$ and $CD$ intersect at $O$. Find $x$ and $y$.

14. In the figure, $AOB$, $COD$ and $FOE$ are straight lines. Find $p$ and $q$.

15. In the figure, $AOB$, $COD$ and $EOF$ are straight lines. Find $x$ and $y$.

16. In the figure, $AOB$, $COD$ and $EOF$ are straight lines. Find $p$.

17. In the figure, $AOB$ is a straight line.
   (a) Find $r$.
   (b) Is $CO$ perpendicular to $AB$? Explain your answer.

   "Explain Your Answer" Questions

   (b) $\therefore \angle COB = r \ (= / \neq) \ 90^\circ$  
   $\therefore CO$ is / is not perpendicular to $AB$.  

Ex 10A 23, 24

Ex 10A 25–27
18. Refer to the figure.
   (a) Find $x$.
   (b) Is $AOC$ a straight line? Explain your answer.

19. Find $x$ in the figure.

20. In the figure, $PQ$ and $RS$ intersect at $O$.
   (a) Find $a$ and $b$.
   (b) Find reflex $\angle POR$. 
10 Angles in Intersecting and Parallel Lines

Consolidation Exercise 10A

Level 1

Find \(x\) in each of the following figures. [Nos. 1–8]

1. \[\begin{array}{c}
\text{320°} \\
\end{array}\]

2. \[\begin{array}{c}
\text{65°} \\
\end{array}\]

3. \[\begin{array}{c}
\text{50°} \\
\end{array}\]

4. \[\begin{array}{c}
\text{145°} \\
\end{array}\]

5. \[\begin{array}{c}
\text{68°} \\
\end{array}\]

6. \[\begin{array}{c}
\text{53°} \\
\end{array}\]

7. \[\begin{array}{c}
\text{160°} \\
\end{array}\]

8. \[\begin{array}{c}
\text{134°} \\
\end{array}\]

In each of the following figures, \(COD\) is a straight line. Find \(x\). [Nos. 9–16]

9. \[\begin{array}{c}
\text{127°} \\
\end{array}\]

10. \[\begin{array}{c}
\text{65°} \\
\end{array}\]
In each of the following figures, straight lines $MN$ and $PQ$ intersect at $O$. Find the unknowns in the figures.

[Nos. 17–24]

17. \[ \begin{align*}
M & \quad Q \\
\quad 100^\circ & \quad \gamma \\
\quad 80^\circ & \quad P \\
\quad N & \quad O
\end{align*} \]

18. \[ \begin{align*}
M & \quad N \\
\quad 27^\circ + \alpha & \quad O \\
\quad 75^\circ & \quad P \\
\quad 27^\circ + \alpha & \quad O
\end{align*} \]

19. \[ \begin{align*}
M & \quad N \\
\quad 55^\circ & \quad y + 80^\circ \\
\quad 128^\circ & \quad x
\end{align*} \]

20. \[ \begin{align*}
M & \quad N \\
\quad \alpha & \quad O \\
\quad 28^\circ & \quad R \\
\quad P & \quad O \\
\quad N & \quad P
\end{align*} \]
In each of the following figures, $AOB$, $COD$ and $EOF$ are straight lines. Find the unknowns in the figures.

[Nos. 25–28]
Find $x$ in each of the following figures. [Nos. 29–30]

29. 

31. Refer to the figure.
   (a) Find $a$.
   (b) Find reflex $\angle AOC$.

In each of the following figures, $AOB$ is a straight line. Find $m$. [Nos. 32–33]

32. 

33. 

34. In the figure, $AOB$ and $COD$ are straight lines.
   (a) Find $x$ and $y$.
   (b) Find reflex $\angle BOC$.

35. In the figure, straight lines $PQ$ and $RS$ intersect at $O$. Find $m$ and $n$. 
36. In the figure, straight lines $AB$ and $CD$ intersect at $O$. It is given that $\angle DOE = \angle EOB$.
   (a) Find $q$.
   (b) Find $\angle DOE$.

37. In the figure, $COD$ and $EOF$ are straight lines. It is given that $MO \perp CD$ and $NO \perp EF$. Find $p$ and $q$.

38. In the figure, straight lines $AB$, $CD$ and $EF$ intersect at $O$.
   (a) Find $x$.
   (b) Find $\angle BOF$.

39. In the figure, $AOB$ and $COD$ are straight lines. If $\angle AOE = 2\angle EOD$, find $\angle AOE$.

40. In the figure, $POQ$ is a straight line.
   (a) Find $x$.
   (b) Is $ROS$ a straight line? Explain your answer.
41. In the figure, straight lines $PQ$, $RS$ and $TU$ intersect at $O$.
   (a) Find $x$.
   (b) Is $RS$ perpendicular to $TU$? Explain your answer.

42. In the figure, $AOB$ is a straight line.
   (a) Express $n$ in terms of $m$.
   (b) It is known that $\angle COD$ is an acute angle. Is it possible that $m = 18^\circ$? Explain your answer.

43. In the figure, straight lines $AB$ and $CD$ intersect at $Q$. Find $p$ and $q$.

44. In the figure, $ABF$, $ACG$ and $DBCE$ are straight lines. Find $m$.

45. In the figure, a mirror $QR$ makes an angle of $120^\circ$ with another mirror $PQ$. A light ray emitted from $A$ meets the mirror $QR$ at $B$ and then reflects in the direction of $BC$. After that, the light ray meets the mirror $PQ$ at $C$ and then reflects in the direction of $CD$. It is given that $\angle ABR = \angle CBQ$ and $\angle BCQ = \angle DCP$. Let $\angle ABR = t$.
   (a) Express $\angle BCQ$ in terms of $t$.
   (b) Express $\angle BCD$ in terms of $t$. 
Consolidation Exercise 10A (Answer)

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<tr>
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<tr>
<td>1.</td>
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<td>2.</td>
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<td>3.</td>
<td>220°</td>
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<td>4.</td>
<td>113°</td>
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<td>264°</td>
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<td>6.</td>
<td>84°</td>
</tr>
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<td>7.</td>
<td>100°</td>
</tr>
<tr>
<td>8.</td>
<td>60°</td>
</tr>
<tr>
<td>9.</td>
<td>53°</td>
</tr>
<tr>
<td>10.</td>
<td>115°</td>
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<td>35°</td>
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<td>12.</td>
<td>50°</td>
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<td>13.</td>
<td>70°</td>
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<td>14.</td>
<td>80°</td>
</tr>
<tr>
<td>15.</td>
<td>65°</td>
</tr>
<tr>
<td>16.</td>
<td>36°</td>
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</table>

17. \( x = 80°, y = 100° \)
18. 46°
19. \( x = 55°, y = 95° \)
20. 118°
21. 41°
22. \( p = 115°, q = 27° \)
23. \( x = 58°, y = 122° \)
24. \( a = 43°, b = 133° \)
25. \( x = 34°, y = 46° \)
26. \( x = 42°, y = 21° \)
27. 40°

28. 66°
29. 40°
30. 20°
31. (a) 18° (b) 288°
32. 70°
33. 16°
34. (a) \( x = 36°, y = 72° \) (b) 252°
35. \( m = 55°, n = 26° \)
36. (a) 34° (b) 39°
37. \( p = 35°, q = 55° \)
38. (a) 30° (b) 60°
39. 76°
40. (a) 21° (b) yes
41. (a) 25° (b) yes
42. (a) \( n = 180° − 5m \) (b) no
43. \( p = 35°, q = 65° \)
44. 15°
45. (a) \( \angle BCQ = 60° − t \)  
(b) \( \angle BCD = 60° + 2t \)
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10.2A Angles Formed by Two Straight Lines and a Transversal

In the figure, a straight line $EF$ intersects two other straight lines $AB$ and $CD$.

The straight line $EF$ is called a transversal of $AB$ and $CD$.

The 8 angles formed are named according to their relative positions.

<table>
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<tr>
<th>Corresponding Angles</th>
<th>Alternate Angles</th>
<th>Interior Angles on the Same Side</th>
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<td><img src="image" alt="Diagram" /></td>
<td><img src="image" alt="Diagram" /></td>
</tr>
</tbody>
</table>

1. In the figure, $EF$ is a transversal of $AB$ and $CD$.

Write down all the pairs of corresponding angles, alternate angles and interior angles on the same side in the figure.

Corresponding angles: $q$ and $m$, _______, _______, _______

Alternate angles: $r$ and $p$, _________

Interior angles on the same side: $r$ and $m$, _________
10.2B Angles Formed by Parallel Lines and a Transversal

I. Corresponding Angles on Parallel Lines

The corresponding angles formed by parallel lines and a transversal are equal.

\[ \text{corr. } \angle s, AB // CD \]

Example 1
In the figure, \( PQ // RS \). Find \( x \).

\[ x = 40^\circ \]

Sol \( x = 40^\circ \) \( \iff \) corr. \( \angle s, PQ // RS \)

Instant Drill 1
In the figure, \( AB // CD \). Find \( y \).

2. In the figure, \( PQ // RS \). Find \( a \).

3. In the figure, \( AB // CD \). Find \( b \).

II. Alternate Angles on Parallel Lines

The alternate angles formed by parallel lines and a transversal are equal.

\[ \text{alt. } \angle s, AB // CD \]

Example 2
In the figure, \( AB // CD \). Find \( x \).

\[ x = 80^\circ \]

Sol \( x = 80^\circ \) \( \iff \) alt. \( \angle s, AB // CD \)

Instant Drill 2
In the figure, \( PQ // RS \). Find \( m \).

\[ m = \]

Sol \( m = \) \( \iff \) alt. \( \angle s, PQ // RS \)
4. In the figure, \( AB \parallel CD \). Find \( y \).

5. In the figure, \( PQ \parallel RS \). Find \( n \).

III. Interior Angles on the Same Side of a Transversal on Parallel Lines

The sum of interior angles on the same side of a transversal on parallel lines is 180°.

i.e. In the figure,

if \( AB \parallel CD \), then \( a + b = 180° \).

[Reference: int. \( \angle \)s, \( AB \parallel CD \)]

Example 3

In the figure, \( PQ \parallel RS \). Find \( x \).

\[
\text{Sol} \quad x + 35° = 180° \quad \text{int. } \angle \text{s, } PQ \parallel RS \\
x = 145°
\]

Instant Drill 3

In the figure, \( AB \parallel CD \). Find \( p \).

\[
\text{Sol} \quad p + (\quad ) = (\quad ) \quad \text{int. } \angle \text{s, } AB \parallel CD
\]

6. In the figure, \( PQ \parallel RS \). Find \( a \).

7. In the figure, \( EF \parallel GH \). Find \( b \).

\( \text{Ex 10B 2, 4} \)
### Example 4
In the figure, $PQ \parallel RS$. Find $x$ and $y$.

![Diagram](https://via.placeholder.com/150)

**Sol**

\[
x + 260^\circ = 360^\circ \quad \triangleleft \text{ } \angle \text{ s at a pt.}
\]

\[
x = 100^\circ
\]

\[
y = x \quad \triangleleft \text{ } \text{corr. } \angle \text{s, } PQ \parallel RS
\]

\[
y = 100^\circ
\]

### Instant Drill 4
In the figure, $AB \parallel CD$. Find $m$ and $n$.

![Diagram](https://via.placeholder.com/150)

**Sol**

\[
(\quad) + m + (\quad) = 180^\circ \quad \triangleleft \text{ } \text{adj. } \angle \text{s on st. line}
\]

\[
n = \quad \triangleleft \text{ } \text{adj. } \angle \text{s, } AB \parallel CD
\]

### 8.
In the figure, $AB \parallel CD$. Find $a$ and $b$.

![Diagram](https://via.placeholder.com/150)

Find $a$ first.

\[
a = 320^\circ
\]

\[
b
\]

### 9.
In the figure, $FK \parallel HG$ and $EFG$ is a straight line. Find $p$ and $q$.

![Diagram](https://via.placeholder.com/150)

Find $p$ first.

\[
p
\]

### 10.
In the figure, $AC \parallel EF$ and $DBE$ is a straight line. Find $x$ and $y$.

![Diagram](https://via.placeholder.com/150)

\[
\angle ABD \text{ and } \angle CBE \text{ are angles.}
\]

### 11.
In the figure, $AB \parallel CD$. Find $p$ and $q$.

![Diagram](https://via.placeholder.com/150)

\[
p
\]

\[
q
\]

\[
p
\]

\[
q
\]

\[
E \quad \text{Ex 10B 7–12}
\]

21
12. Find $x$ and $y$ in the figure.

13. Find $m$ and $n$ in the figure.

14. Find $a$ in the figure.

15. Find $y$ in the figure.

16. In the figure, $SU \parallel AC$ and $PTBQ$ is a straight line. Find $a$ and $b$. 

17. In the figure, $AB \parallel EF \parallel CD$ and $BEC$ is a straight line. Find $x$ and $y$. 

[@Ex 10B 13–18] 
[@Ex 10B 19] 
[@Ex 10B 20–23]
18. In the figure, $AB \parallel CD$ and $CB \parallel DE$. Are $x$ and $y$ equal? Explain your answer.

$x = \underline{\phantom{00}}$

\[\therefore \ x (= \neq) y\]

i.e. $x$ and $y$ (are / are not) equal.

---

19. In the figure, $DE \parallel CA$ and $FDCB$ is a straight line. Find $x$.

20. In the figure, $AB \parallel CF \parallel EG$. Find $x$ and $y$. 

---

23
10 Angles in Intersecting and Parallel Lines

Level 1

In each of the following figures, $AB \parallel CD$. Find $x$. [Nos. 1–4]

1.

2.

3.

4.

In each of the following figures, $EF \parallel GH$. Find $x$. [Nos. 5–8]

5.

6.

7.

8.
Find the unknown(s) in each of the following figures. **[Nos. 9–14]**

9. 

10. 

11. 

*EFGH* is a straight line.

*ABCD* is a straight line.

*ABC* and *BFH* are straight lines.

12. 

13. 

14. 

*ADE* is a straight line.

*PQRS* is a straight line.

Find the unknowns in each of the following figures. **[Nos. 15–20]**

15. 

16. 

17. 

**25**
21. In the figure, $PQRS$ is a straight line. Find $x$ and $y$.

22. In the figure, $BDE$ is a straight line. Find $m$ and $n$.

23. In the figure, $PRU$ is a straight line. Find $p$ and $q$. 
Find the unknown(s) in each of the following figures. [Nos. 24–26]

24. \( P \rightarrow Q \)  
   60°  
   R  
   \( T \)  
   75°  
   S  
   Y  
   Z  
   U  

\( QX \) and \( XTZ \) are straight lines.

25.  
PAC and QEC are straight lines.

26. \( B \rightarrow D \)  
   82°  
   E  
   A  
   C  
   \( D \)  
   \( m \)  
   \( n \)  

\( ADGH \) is a straight line.

Level 2

Find the unknown(s) in each of the following figures. [Nos. 27–32]

27.  

28.  

29.  

30.  

\( EFGH \) is a straight line.

31.  

32.  

\( R \rightarrow S \)  
   50°  
   \( T \)  
   \( y \)  
   \( P \)  
   \( U \)  
   \( x \)  
   \( 88° \)  
   \( Q \)  

\( BOG \) and \( COF \) are straight lines.
33. In the figure, PR // SU and QU // PV. Is it true that \( p + q = 180^\circ \)?

Explain your answer.

34. In the figure, AE is parallel to BF and ABCD is a straight line.

Find \( \angle BFD \).

Find the unknown in each of the following figures. [Nos. 35–43]

35. [Diagram]

36. [Diagram]

37. [Diagram]

38. [Diagram]

39. [Diagram]

40. [Diagram]

41. [Diagram]

42. [Diagram]

43. [Diagram]

44. In the figure, BA // EF and BC \perp CD. Find \( x \).
Consolidation Exercise 10B (Answer)

1. 75°  
2. 40°  
3. 132°  
4. 86°  
5. 100°  
6. 80°  
7. 40°  
8. 43°  
9. $a = 115^\circ$, $b = 115^\circ$  
10. $x = 70^\circ$, $y = 110^\circ$, $z = 70^\circ$  
11. $a = 45^\circ$, $b = 30^\circ$, $c = 150^\circ$  
12. 260°  
13. 145°  
14. $x = 80^\circ$, $y = 60^\circ$  
15. $x = 118^\circ$, $y = 118^\circ$  
16. $p = 124^\circ$, $q = 56^\circ$  
17. $a = 65^\circ$, $b = 65^\circ$, $c = 65^\circ$  
18. $m = 30^\circ$, $n = 150^\circ$  
19. $p = 70^\circ$, $q = 70^\circ$, $r = 110^\circ$  
20. $x = 135^\circ$, $y = 225^\circ$  
21. $x = 108^\circ$, $y = 72^\circ$  
22. $m = 43^\circ$, $n = 43^\circ$  
23. $p = 30^\circ$, $q = 10^\circ$  
24. $a = 75^\circ$, $b = 45^\circ$  
25. 28°  
26. $m = 58^\circ$, $n = 122^\circ$  
27. 75°  
28. 115°  
29. $x = 55^\circ$, $y = 105^\circ$  
30. 35°  
31. 225°  
32. $x = 50^\circ$, $y = 62^\circ$  
33. yes  
34. 40°  
35. 265°  
36. 27°  
37. 140°  
38. 66°  
39. 24°  
40. 27°  
41. 35°  
42. 60°  
43. 70°  
44. 50°
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Teacher’s Signature

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10.3 Conditions for Parallel Lines

(a) Corresponding angles equal

If the corresponding angles formed by two lines and a transversal are equal, then the two lines are parallel.

i.e. In the figure, if \( a = b \), then \( AB \parallel CD \).

[Reference: corr. \( \angle \)s equal]

Example 1
In the figure, \( ABC \) is a straight line. Is \( EB \) parallel to \( DC \)?

\[
\begin{align*}
\angle EBA &= \angle DCA = 60^\circ \\
\therefore EB &\parallel DC \quad \text{\( \triangle \text{corr. \( \angle \)s equal} \) }
\end{align*}
\]

Sol

\[
\begin{align*}
\therefore \angle EBA &= \angle DCA = 60^\circ \\
\therefore EB &\parallel DC \quad \text{\( \triangle \text{corr. \( \angle \)s equal} \) }
\end{align*}
\]

Example 2
In the figure, \( QST \) is a straight line. Is \( PQ \) parallel to \( RS \)?

\[
\begin{align*}
\therefore \angle QST &= \angle SRT = ( ) \\
\therefore \angle QST &= \angle SRT = ( )
\end{align*}
\]

Sol

\[
\begin{align*}
\therefore \angle QST &= \angle SRT = ( ) \\
\therefore \angle QST &= \angle SRT = ( )
\end{align*}
\]

1. In the figure, \( BCD \) is a straight line. Is \( AB \) parallel to \( EC \)? Give reasons.

\[
\begin{align*}
\angle ABD &= ( ) + ( ) = \\
\therefore \angle &= \angle = \\
\therefore \text{ __________ } &= ( )
\end{align*}
\]

2. In the figure, \( ABC \) and \( ECF \) are straight lines. Is \( DB \) parallel to \( EF \)? Give reasons.

\[
\begin{align*}
\angle ABD &= ( ) + ( ) = \\
\therefore \angle &= \angle = \\
\therefore \text{ __________ } &= ( )
\end{align*}
\]

Write down the reason.
(b) **Alternate angles equal**

If the alternate angles formed by two lines and a transversal are equal, then the two lines are parallel.

i.e. In the figure, if \( a = b \), then \( AB \parallel CD \).

[Reference: alt. \( \angle \)s equal]

**Example 2**

Refer to the figure. Is \( AB \) parallel to \( CD \)?

\[
\begin{array}{c}
A \hspace{1cm} B \\
C \hspace{1.5cm} D
\end{array}
\]

\[
\angle ABC = \angle BCD = 50^\circ
\]

\[\therefore AB \parallel CD\hspace{1cm}\text{alt. } \angle \text{s equal}\]

**Instant Drill 2**

Refer to the figure. Is \( PQ \) parallel to \( RS \)?

\[
\begin{array}{c}
P \hspace{1cm} Q \\
R \hspace{1.5cm} S
\end{array}
\]

\[\angle \hspace{1cm} \angle = \angle \hspace{1cm} (\quad )\]

\[\therefore \hspace{1cm} \text{alt. } \angle \text{s equal}\]

3. Refer to the figure. Is \( AB \) parallel to \( CD \)? Give reasons.

\[
\begin{array}{c}
A \hspace{1.5cm} E \hspace{1cm} C \hspace{1.5cm} D
\end{array}
\]

4. Refer to the figure. Is \( PQ \) parallel to \( RS \)? Give reasons.

\[
\begin{array}{c}
P \hspace{1cm} Q \hspace{1cm} R \hspace{1cm} S
\end{array}
\]

\[\text{Ex 10C 3, 5}\]
(c) Interior angles on the same side of a transversal supplementary

If the interior angles on the same side of a transversal formed by two lines and the transversal are supplementary, then the two lines are parallel.
i.e. In the figure,
if $a + b = 180^\circ$, then $AB \parallel CD$.
[Reference: int. $\angle$s supp.]

**Example 3**
Refer to the figure. Is $AB$ parallel to $DC$?

\[ \angle ABC + \angle BCD = 135^\circ + 45^\circ = 180^\circ \]
\[ \therefore AB \parallel DC \quad \text{int. $\angle$s supp.} \]

**Instant Drill 3**
Refer to the figure. Is $PQ$ parallel to $SR$?

\[ \angle PQR + \angle QRS = (\quad ) + (\quad ) = \]
\[ \therefore \quad \text{int. $\angle$s supp.} \]

5. Refer to the figure. Is $AB$ parallel to $DC$? Give reasons.

6. Refer to the figure. Is $AB$ parallel to $DC$? Give reasons.

7. In the figure, $CDE$ and $BDF$ are straight lines. Is $BA$ parallel to $EC$? Give reasons.

\[ \therefore \text{Ex 10C 2, 4, 6} \]

Which line segment would you choose as a transversal, $BD$ or $BC$?
8. In the figure, \(PUQ\) is a straight line. Write down all the pairs of parallel lines in the figure and give reasons.

\[ \begin{align*}
\text{Pairs of Parallel Lines:} & \quad \overline{PS} \parallel \overline{QR} \\
\text{Reasons:} & \quad \text{Alternate Interior Angles}
\end{align*} \]

9. In the figure, \(CBA\) is a straight line. Write down all the pairs of parallel lines in the figure and give reasons.

\[ \begin{align*}
\text{Pairs of Parallel Lines:} & \quad \overline{AB} \parallel \overline{DC} \\
\text{Reasons:} & \quad \text{Corresponding Angles}
\end{align*} \]

10. Refer to the figure.
   (a) Is \(AB\) parallel to \(DC\)? Give reasons.
   (b) Is \(BDE\) a straight line? Explain your answer.
11. In the figure, $AC \parallel DF$.
   
   (a) Find $x$.
   
   (b) Is it true that $CE \parallel BD$? Give reasons.

12. Refer to the figure. Is $AB$ parallel to $DE$? Give reasons.

Add an auxiliary line $FC$ such that $FC \parallel AB$. Is $FC$ parallel to $DE$?
10 Angles in Intersecting and Parallel Lines

Level 1

In each of the following figures, $AD$ intersects $PQ$ and $RS$ at $B$ and $C$ respectively. Determine whether $PQ$ and $RS$ are parallel. [Nos. 1–4]

1. 

2. 

3. 

4. 

In each of the following, determine whether $PQ$ and $RS$ are parallel. [Nos. 5–10]

5. 

6. 

7. 

8. 

9. 

10. 

$PRU$ and $QRT$ are straight lines.

$PRTV$ and $QSTU$ are straight lines.
Write down all the pairs of parallel lines in the following figures and give reasons. [Nos. 11–14]

11.  
![Diagram of figure 11.](image1)

**PQR and VSR are straight lines.**

12.  
![Diagram of figure 12.](image2)

13.  
![Diagram of figure 13.](image3)

**POBQ and COD are straight lines.**

14.  
![Diagram of figure 14.](image4)

**PQR and XYZ are straight lines.**

15. Refer to the figure.

   (a) Is it true that \( PQ \parallel RS \)? Give reasons.

   (b) Is it true that \( RS \parallel TU \)? Give reasons.

   (c) Using the results of (a) and (b), determine whether \( PQ \) and \( TU \) are parallel and give reasons.

16. In the figure, \( PQR \) is a straight line.

   (a) Is \( XQ \) parallel to \( YZ \)? Give reasons.

   (b) Is \( XY \) parallel to \( QZ \)? Give reasons.

---

**Level 2**

17. Refer to the figure. Is \( AB \) parallel to \( CD \)? Give reasons.
18. In the figure, $AC \parallel DF$. Is $BE$ parallel to $CF$? Give reasons.

19. In the figure, $BCG$ and $CED$ are straight lines. If $AB \parallel CD$, is $EF$ parallel to $BG$? Give reasons.

20. In the figure, $PQR$ is a straight line and $QS \parallel UT$.
   (a) Find $x$.
   (b) Is $PR$ parallel to $UV$? Give reasons.

21. In the figure, $BCD$ is a straight line. $BD \parallel EF$ and $DB \perp BE$.
   (a) Find $x$.
   (b) Is it true that $CE \parallel BA$? Give reasons.

22. In the figure, $ABD$ is a straight line and $CB \parallel ED$.
   (a) Find $y$.
   (b) Write down all other pairs of parallel lines in the figure and give reasons.
23. In the figure, $AB \parallel CD$.
   (a) Find $x$.
   (b) Write down all other pairs of parallel lines in the figure and give reasons.

24. In the figure, $PQ \parallel RS$, $\angle QPR = 120^\circ$, $\angle SRU = x + 10^\circ$, $\angle RUT = 2x - 20^\circ$ and reflex $\angle PRU = 8x + 20^\circ$.
   (a) Find $x$.
   (b) Is it true that $PQ \parallel TU$? Give reasons.

25. In the figure, $QR \perp RS$. Is $PQ$ parallel to $TS$? Give reasons.

26. In the figure, $PAQ$ and $RCQ$ are straight lines. Is it true that $AB \parallel CD$? Give reasons.

27. In the figure, $\angle ABC = 46^\circ$, $\angle CDE = 111^\circ$ and reflex $\angle BCD = 245^\circ$. Is $AB$ parallel to $DE$? Give reasons.
Consolidation Exercise 10C (Answer)

1. yes  
2. yes  
3. yes  
4. no  
5. yes  
6. yes  
7. no  
8. yes  
9. no  
10. no  
11. $ST \parallel PR$, alt. $\angle$s equal; $UQ \parallel VR$, int. $\angle$s supp.  
12. $PR \parallel SU$, int. $\angle$s supp.  
13. $AB \parallel CD$, corr. $\angle$s equal  
14. $QS \parallel RT$, corr. $\angle$s equal  
15. (a) yes, alt. $\angle$s equal  
    (b) yes, int. $\angle$s supp.  
    (c) yes, since both $PQ$ and $TU$ are parallel to $RS$  
16. (a) yes, int. $\angle$s supp.  
    (b) yes, int. $\angle$s supp.  
17. yes, int. $\angle$s supp.  
18. no  
19. yes, corr. $\angle$s equal (or alt. $\angle$s equal)  
20. (a) $85^\circ$  
    (b) yes, int. $\angle$s supp. (or alt. $\angle$s equal)  
21. (a) $18^\circ$  
22. (a) $57^\circ$  
    (b) $ED \parallel FG$, int. $\angle$s supp.; $CB \parallel FG$, since both $CB$ and $FG$ are parallel to $ED$  
23. (a) $14^\circ$  
    (b) $BC \parallel ED$, int. $\angle$s supp.; $CD \parallel EF$, alt. $\angle$s equal; $AB \parallel EF$, since both $AB$ and $EF$ are parallel to $CD$  
24. (a) $30^\circ$  
    (b) yes, since both $PQ$ and $TU$ are parallel to $RS$  
25. yes, alt. $\angle$s equal (or int. $\angle$s supp.)  
26. yes, corr. $\angle$s equal  
27. yes, int. $\angle$s supp. (or alt. $\angle$s equal)
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11.1A Congruent Figures

If two figures have the same shape and size, they are called congruent figures.

1. Determine whether each pair of figures below are congruent by observation only.

(a) ![Figure](image1)
(b) ![Figure](image2)
(c) ![Figure](image3)
(d) ![Figure](image4)

11.1B Congruent Triangles

If two triangles are congruent, then their corresponding angles and corresponding sides are equal.

\[
\triangle ABC \cong \triangle PQR,
\]

- \(\angle A = \angle P, \angle B = \angle Q, \angle C = \angle R\);
- \(AB = PQ, BC = QR, AC = PR\).

Example 1

Name a pair of congruent triangles shown in the figure.

![Triangle](image5)

**Sol** By considering the corresponding angles and sides of the two triangles, we have \(\triangle ABC \cong \triangle DEF\).

Write down \(\triangle ABC\), then consider the corresponding angles of \(\angle A, \angle B\) and \(\angle C\) respectively.

Instant Drill 1

Name a pair of congruent triangles shown in the figure.

![Triangle](image6)

**Sol** By considering the corresponding angles and sides of the two triangles, we have \(\triangle XYZ \cong \triangle\).

Write down \(\triangle XYZ\), then consider the corresponding angles of \(\angle X, \angle Y\) and \(\angle Z\) respectively.
2. Name a pair of congruent triangles shown in the figure.

3. Name a pair of congruent triangles shown in the figure.

Example 2
In the figure, \( \triangle ABC \cong \triangle YXZ \). Find \( a \) and \( x \).

\[
\begin{align*}
\triangle ABC & \cong \triangle YXZ \\
\therefore \quad \angle A &= \angle Y \\
n & = 70^\circ \\
\angle X &= \angle B \\
x & = 50^\circ
\end{align*}
\]

\( \triangle ABC \cong \triangle YXZ \)

Example 3
In the figure, \( \triangle IJK \cong \triangle STU \). Find \( k \) and \( s \).

\[
\begin{align*}
\triangle IJK & \cong \triangle STU \\
\therefore \quad IJ &= ST \\
\therefore \quad k &= 8 \text{ m} \\
TU &= JK \\
\therefore \quad s &= 15 \text{ m}
\end{align*}
\]

\( \triangle IJK \cong \triangle STU \)

Instant Drill 2
In the figure, \( \triangle PQR \cong \triangle DFE \). Find \( p \) and \( f \).

\[
\begin{align*}
\triangle PQR & \cong \triangle DFE \\
\therefore \quad \angle P &= \angle D \\
p & = 110^\circ \\
\angle F &= \angle \underline{\text{______}} \\
f & = 170^\circ
\end{align*}
\]

\( \triangle PQR \cong \triangle DFE \)

Instant Drill 3
In the figure, \( \triangle XYZ \cong \triangle RPQ \). Find \( x \) and \( p \).

\[
\begin{align*}
\triangle XYZ & \cong \triangle RPQ \\
\therefore \quad YZ &= 12 \text{ m} \\
\therefore \quad x &= 12 \text{ m} \\
QR &= 18 \text{ m} \\
\therefore \quad p &= 18 \text{ m}
\end{align*}
\]

\( \triangle XYZ \cong \triangle RPQ \)
4. In the figure, $\triangle XYZ \cong \triangle PQR$.
   Find $a$ and $c$.

```
  X
  |  |
  |  |
---|---|---
  60°| 6 cm|
```

```
  P
  |  |
  |  |
---|---|---
  a|  c|
```

5. In the figure, $\triangle LMN \cong \triangle SRT$.
   Find $x$ and $y$.

```
  L
  |  |
  |  |
---|---|---
  120°| 45°|
```

```
  N
  |  |
  |  |
---|---|---
  x|  y|
```

6. In the figure, $\triangle ABC \cong \triangle DEF$.
   Find $x$, $y$ and $z$.

```
  A
  |  |
  |  |
---|---|---
  3.4| 4|
```

```
  E
  |  |
  |  |
---|---|---
  55°|  z|
```

7. In the figure, $\triangle XYZ \cong \triangle RQP$.
   Find $a$ and $b$.

```
  X
  |  |
  |  |
---|---|---
  82°| 7|
```

```
  P
  |  |
  |  |
---|---|---
  a-1| 2b|
```
‘Explain Your Answer’ Questions

8. In the figure, \( \triangle ABC \cong \triangle FDE \). Is \( \triangle ABC \) an isosceles triangle? Explain your answer.

\[
\therefore \ \triangle ABC \cong \triangle \underline{______}
\]

\[
\therefore \ BC =
\]

\[
\text{Remember to write down the reason.}
\]

\[
\therefore \ \triangle ABC \ (\text{is } / \text{is not}) \ an \ isosceles \ triangle.
\]

9. In the figure, \( \triangle ABC \cong \triangle ADC \). Is \( BCD \) a straight line?

Explain your answer.

\[
\text{Find } \angle BCD \text{ first.}
\]

Level Up Question

10. It is given that \( \triangle PQR \cong \triangle XYZ \). \( PQ = 5 \text{ cm} \), \( QR = 10 \text{ cm} \) and \( XZ = 8 \text{ cm} \). Find \( PR \) and \( YZ \).
11 Congruence and Similarity

Level 1

1. Determine whether each pair of figures below are congruent by observation only.

(a)

(b)

(c)

(d)

2. Find out all pairs of congruent figures in the following by observation only.

A  B  C  D  E  F

3. In each of the following, figure $Q$ is the image of figure $P$ after a certain transformation relative to the fixed point ‘$\times$’.

(i) Write down the type of transformation.
(ii) Determine whether $P$ and $Q$ are congruent.

(a)

(b)

(c)

(d)

(e)

4. In the figure, $\triangle ABC \cong \triangle DEF$. Name all the corresponding
angles of the two congruent triangles.

5. In the figure, $\triangle JKL \cong \triangle XYZ$. Name all the corresponding sides of the two congruent triangles.

Name a pair of congruent triangles in each of the following figures. [Nos. 6–9]

6.  
7.  
8.  
9.  

Find the unknowns in each of the following pairs of congruent triangles. [Nos. 10–15]

10. $\triangle ABC \cong \triangle PQR$

11. $\triangle DEF \cong \triangle STU$
12. $\triangle LMN \cong \triangle XYZ$

13. $\triangle BAC \cong \triangle FDE$

14. $\triangle HKG \cong \triangle UST$

15. $\triangle MLN \cong \triangle QRP$

**Level 2**

16. Divide the figure on the right into
   (a) two congruent figures,
   (b) three congruent figures.

Write down a pair of congruent triangles in each of the following figures. [Nos. 17–18]
Find the unknowns in each of the following pairs of congruent triangles. [Nos. 19–20]

19. \( \triangle PQR \cong \triangle TSR \)

20. \( \triangle ABF \cong \triangle DEC \)

21. In the figure, \( ACD \) is a straight line. If \( \triangle ABC \cong \triangle EDA \), find \( CD \).

22. It is given that \( \triangle PQR \cong \triangle XYZ \). \( PQ = 4 \text{ cm}, QR = 7 \text{ cm} \) and \( RP = 10 \text{ cm} \).
   (a) Find \( YZ \).
   (b) Find \( XZ \).
   (c) Find \( XY \).

23. It is given that \( \triangle ABC \cong \triangle DEF \). \( \angle D = 55^\circ \) and \( \angle B = 65^\circ \).
   (a) Find \( \angle E \).
   (b) Find \( \angle A \).
   (c) Find \( \angle C \).

24. It is given that \( \triangle FGH \cong \triangle MNL \). \( \angle M = 90^\circ \), \( \angle H = 60^\circ \), \( NL = 12 \text{ cm} \) and \( FH = 6 \text{ cm} \).
   (a) Find \( ML \).
   (b) Find \( GH \).
   (c) Find \( \angle F \).
   (d) Find \( \angle N \).

25. In the figure, \( \triangle PQR \cong \triangle PSR \) and \( \angle PQR = 45^\circ \).
   (a) Find \( \angle QPR \).
   (b) Is \( QP \) perpendicular to \( SP \)? Explain your answer.

26. In the figure, \( PQR, PUS, TSR \) and \( TUQ \) are straight lines. It is given that \( \triangle PRS \cong \triangle TRQ \). \( PQ = 2RS \) and \( QR = 4 \text{ cm} \). Find \( RT \).

27. In the figure, \( AEC \) and \( BED \) are straight lines. It is given that \( \triangle ABC \cong \triangle DCB \). Find
   (a) \( \angle BDC \),
   (b) \( \angle DBC \),
   (c) \( \angle DCB \).
Consolidation Exercise 11A (Answer)

1. (a) yes (b) yes (c) no (d) yes
2. A and C, B and E
3. (a) (i) translation (ii) yes (b) (i) rotation (ii) yes (c) (i) reduction (ii) no (d) (i) reflection (ii) yes (e) (i) enlargement (ii) no
4. ∠A and ∠D, ∠B and ∠E, ∠C and ∠F
5. JK and XY, KL and YZ, JL and XZ
6. △PQR ≡ △XYZ
7. △ABC ≡ △VUT
8. △ABC ≡ △MNL
9. △DEF ≡ △RQP
10. q = 68°, r = 60°
11. x = 8, y = 4

12. n = 4, y = 5, z = 47°
13. b = 5, d = 39°, e = 35°
14. k = 9, t = 4
15. p = 58°, r = 20°
17. △ABC ≡ △CDA
18. △KLN ≡ △MLN
19. p = 47°, x = 10.2, y = 9
20. a = 76°, c = 9, e = 43°
21. 4 cm
22. (a) 7 cm (b) 10 cm (c) 4 cm
23. (a) 65° (b) 55° (c) 60°
24. (a) 6 cm (b) 12 cm (c) 90° (d) 30°
25. (a) 45° (b) yes
26. 12 cm
27. (a) 39° (b) 25° (c) 116°
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11.2A Three Sides Equal (SSS)

If \( AB = XY \), \( BC = YZ \) and \( CA = ZX \),
then \( \triangle ABC \cong \triangle XYZ \).

[Reference: SSS] \( \text{’SSS’ stands for ‘Side-Side-Side’}. \)
i.e. Three sides equal.

Example 1
Write down a pair of congruent triangles in the figure and give reasons.

\[
\begin{align*}
\triangle DEF & \cong \triangle XYZ \quad (\text{SSS}) \\
& \quad \quad \text{(Find out three pairs of equal corresponding sides first.)}
\end{align*}
\]

Sol
Find out three pairs of equal corresponding sides first.
\( DE = XY = 2, \ EF = YZ = 3, \ DF = XZ = 4 \).
\( \triangle DEF \cong \triangle XYZ \) (SSS)

Mind the order of vertices when naming congruent triangles.

Instant Drill 1
Write down a pair of congruent triangles in the figure and give reasons.

\[
\begin{align*}
\triangle HIJ & \cong \triangle KLM \quad (\text{SSS}) \\
& \quad \quad \text{(Find out three pairs of equal corresponding sides first.)}
\end{align*}
\]

Sol
Find out three pairs of equal corresponding sides first.
\( HI = _____ = 6, \ IJ = _____ = 8, \ JH = _____ = 7 \).
\( \triangle HIJ \cong \triangle KLM \) (SSS)
11.2B Two Sides and the Included Angle Equal (SAS)

If \( AB = XY \), \( \angle B = \angle Y \) and \( BC = YZ \), then \( \triangle ABC \cong \triangle XYZ \).


Example 2
Determine whether the two triangles below must be congruent. If yes, give reasons.

\[
\begin{align*}
\triangle GHI & \cong \triangle KJL \quad \text{(SAS)} \\
\angle G &= \angle K = 3 \\
\triangle H &= \triangle J = 75^\circ \\
HI &= JL = 4
\end{align*}
\]

Sol

Yes, \( \triangle GHI \cong \triangle KJL \) (SAS).

Instant Drill 2
Determine whether the two triangles below must be congruent. If yes, give reasons.

Ex 11B 4, 6, 7

Ex 11B 13, 15

3. Determine whether the two triangles below must be congruent. If yes, give reasons.

4. Determine which two triangles below must be congruent and give reasons.

Note that in ‘SAS’, the ‘A’ must be the included angle between the two ‘S’s.
11.2C Two Angles and One Side Equal (ASA or AAS)

If $\angle A = \angle X$, $AB = XY$ and $\angle B = \angle Y$,
then $\triangle ABC \cong \triangle XYZ$.

i.e. Two angles and the included side equal.

Example 3
Write down a pair of congruent triangles in the figure and give reasons.

Instant Drill 3
Write down a pair of congruent triangles in the figure and give reasons.

Example 4
Write down a pair of congruent triangles in the figure and give reasons.

Instant Drill 4
Write down a pair of congruent triangles in the figure and give reasons.

i.e. Two angles and a non-included side equal.
5. Determine whether the two triangles below must be congruent. If yes, give reasons.

6. Determine whether the two triangles below must be congruent. If yes, give reasons.

7. Determine which two triangles below must be congruent and give reasons.
If $\angle C = \angle Z = 90^\circ$, $AB = XY$ and $BC = YZ$,
then $\triangle ABC \cong \triangle XYZ$.

[Reference: RHS] 'RHS' stands for 'Right angle-Hypotenuse-Side'.

**Example 5**
Write down a pair of congruent triangles in the figure and give reasons.

\[ \triangle DEF \cong \triangle LNM \text{ (RHS)} \]

\[ \angle E = \angle N = 90^\circ \]
\[ DF = LM = 8 \]
\[ EF = NM = 7 \]

**Instant Drill 5**
Write down a pair of congruent triangles in the figure and give reasons.

**Sol**

Determine whether
(i) both triangles have right angles;
(ii) their hypotenuses are equal;
(iii) another pair of corresponding sides equal.

8. Determine whether the two triangles below must be congruent. If yes, give reasons.

9. Determine which two triangles below must be congruent and give reasons.
10. Determine which two triangles below must be congruent and give reasons.

Choose a suitable reason to determine congruent triangles.

11. (a) Determine whether the two triangles in the figure must be congruent. If yes, give reasons.
(b) Kelly claims that \(x = y\). Do you agree? Explain your answer.

12. Refer to the two triangles in the figure. Are the lengths of \(AB\) and \(PQ\) equal? Explain your answer.
13. In the figure, \( BDC \) is a straight line.
   (a) Find \( \angle ADB \).
   (b) Determine whether \( \triangle ADB \) and \( \triangle ADC \) must be congruent.
       If yes, give reasons.

14. Refer to the figure.
   (a) Write down a pair of congruent triangles in the figure and give reasons.
   (b) Find \( x \).
   (c) Find \( y \).
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11.3A Similar Figures

If two figures have the same shape, they are called similar figures.

1. Determine whether each of the following pairs of figures are similar by observation only.

(a) ![Star/Star](Image)

(b) ![Rectangle/Rectangle](Image)

(c) ![Arrow/Arrow](Image)

(d) ![Rectangle/Arrow](Image)

(e) ![Rectangle/Triangle](Image)

(f) ![Triangle/Triangle](Image)

Ex 11C 1, 2

11.3B Similar Triangles

If two triangles are similar, then their **corresponding angles are equal** and their **corresponding sides are proportional**.

![Triangles](Image)

In the figure above, given that $\triangle ABC \sim \triangle PQR$, we have

(a) $\angle A = \angle P$, $\angle B = \angle Q$, $\angle C = \angle R$;

(b) $\frac{AB}{PQ} = \frac{BC}{QR} = \frac{CA}{RP}$.

\(\sim\) Vertices $A$, $B$ and $C$ correspond to vertices $P$, $Q$ and $R$ respectively. ‘~’ represents ‘is similar to’.
Example 1
Name a pair of similar triangles shown in the figure.

Sol By considering the corresponding angles and sides of the two triangles, we have \( \triangle DEF \sim \triangle XYZ \).

Write down \( \triangle DEF \), then consider the corresponding angles of \( \angle D, \angle E \) and \( \angle F \) respectively.

Instant Drill 1
Name a pair of similar triangles shown in the figure.

Sol By considering the corresponding angles and sides of the two triangles, we have \( \triangle PQR \sim \triangle XYZ \).

Write down \( \triangle PQR \), then consider the corresponding angles of \( \angle P, \angle Q \) and \( \angle R \) respectively.

2. Name a pair of similar triangles shown in the figure.

Example 2
In the figure, \( \triangle PQR \sim \triangle TUV \). Find \( x \) and \( y \).

Sol \( \therefore \) \( \triangle PQR \sim \triangle TUV \)

\( \therefore \) \( \angle P = \angle T \)

\( x = 60^\circ \)

\( \frac{PQ}{TU} = \frac{QR}{UV} \)

\( \frac{y}{8} = \frac{6}{12} \)

\( y = \frac{6 \times 8}{12} = 4 \)

Instant Drill 2
In the figure, \( \triangle ABC \sim \triangle ZYX \). Find \( p \) and \( q \).

Sol \( \therefore \) \( \triangle ABC \sim \triangle ZYX \)

\( \therefore \) \( \angle Z = \angle \)\( \)

\( \frac{BC}{AC} = \frac{20}{(\quad)} \)

\( \frac{q}{(\quad)} = 20 \)

\( \therefore \) \( \triangle ABC \sim \triangle ZYX \)

\( \therefore \) \( \angle Z = \angle \)\( \)

\( \frac{BC}{AC} = \frac{20}{(\quad)} \)

\( \frac{q}{(\quad)} = 20 \)

\( \therefore \) \( \triangle ABC \sim \triangle ZYX \)

\( \therefore \) \( \angle Z = \angle \)\( \)

\( \frac{BC}{AC} = \frac{20}{(\quad)} \)

\( \frac{q}{(\quad)} = 20 \)

\( \therefore \) \( \triangle ABC \sim \triangle ZYX \)

\( \therefore \) \( \angle Z = \angle \)\( \)

\( \frac{BC}{AC} = \frac{20}{(\quad)} \)

\( \frac{q}{(\quad)} = 20 \)
3. In the figure, $\triangle DEF \sim \triangle GHI$.
Find $m$ and $n$.

4. In the figure, $\triangle RST \sim \triangle LKJ$.
Find $x$, $y$ and $z$.

5. In the figure, $\triangle XYZ \sim \triangle EGF$.
Find $r$ and $s$.

6. In the figure, $\triangle ABC \sim \triangle NLM$.
Find $x$ and $y$. 

\[ \text{Ex } 11C \ 5-10 \]

\[ \text{Ex } 11C \ 11, 12 \]

---

Ex 11C 5–10
Ex 11C 11, 12
7. In the figure, $\triangle ABC \sim \triangle PQR$. Is $\triangle ABC$ an equilateral triangle? Explain your answer.

$\therefore \quad \triangle ABC \sim \triangle \underline{\ }

\therefore \quad \frac{AC}{(\underline{\ })} = \frac{(\underline{\ })}{(\underline{\ })}

$\therefore \quad \triangle ABC$ (is / is not) an equilateral triangle.

8. In the figure, $\triangle ABC \sim \triangle DEC$.

(a) Find $x$.

(b) Find $y$.

(c) Is $BCE$ a straight line? Explain your answer.
9. It is given that $\triangle ABC \sim \triangle XYZ$. $AB = 6$ cm, $AC = XY = 9$ cm. Find $ZX$.

10. In the figure, $\triangle ABC \sim \triangle DEC$. Find $x$ and $y$. 
11 Congruence and Similarity

Level 1

1. Determine whether each pair of figures below are similar by observation only.
   (a)  
   (b)  
   (c)  
   (d)  

2. Find out all pairs of similar figures in the following by observation only.

   \[ \triangle PQR \sim \triangle ZYX. \]
   (a) Name all the corresponding angles of the two similar triangles.
   (b) Name all the corresponding sides of the two similar triangles.

3. Name a pair of similar triangles in each of the following figures.
Find the unknowns in each of the following pairs of similar triangles. [Nos. 5–12]

5. $\triangle ABC \sim \triangle LMN$

6. $\triangle DEF \sim \triangle RPQ$

7. $\triangle FGH \sim \triangle TUS$

8. $\triangle LMN \sim \triangle ZYX$

9. $\triangle BAC \sim \triangle PRQ$

10. $\triangle JKL \sim \triangle TSR$

11. $\triangle EFD \sim \triangle XYZ$

12. $\triangle ABC \sim \triangle TSU$

Level 2

13. In the figure, $\triangle PQR \sim \triangle ZYX$. Find $r$ and $z$. 
14. In the figure, $\triangle PQR \sim \triangle SRP$. Find $p$ and $x$.

15. It is given that $\triangle PQR \sim \triangle LMN$. $\angle P = 80^\circ$ and $\angle N = 40^\circ$.
   (a) Find $\angle R$.  (b) Find $\angle L$.  (c) Find $\angle M$.

16. It is given that $\triangle ABC \sim \triangle PRQ$. $\angle B = 65^\circ$, $BA = 16$ cm, $BC = 12$ cm and $RP = 10$ cm.
   (a) Find $\angle R$.  (b) Find $RQ$.

17. It is given that $\triangle DFE \sim \triangle YZX$. $\angle X = 35^\circ$, $\angle Z = 100^\circ$, $XZ = 24$ cm and $4YZ = 3DF$.
   (a) Find $\angle F$.  (b) Find $\angle D$.  (c) Find $EF$.

18. In the figure, $ABC$ and $AED$ are straight lines. If $\triangle ABE \sim \triangle ACD$, find $k$.

19. In the figure, $PQS$ and $PRT$ are straight lines. It is given that $\triangle PQR \sim \triangle PST$, $QR = 5$ and $ST = 15$. Is it true that $RT = 2PR$? Explain your answer.

20. In the figure, $NOPQ$ and $OSR$ are straight lines. It is given that $\triangle MNO$, $\triangle SPO$ and $\triangle RQO$ are three similar triangles. Find the lengths of $NO$ and $SR$. 
Consolidation Exercise 11C

1. (a) yes (b) no (c) no (d) yes

2. A and E, B and D, C and F

3. (a) \( \angle P \) and \( \angle Z \), \( \angle Q \) and \( \angle Y \), \( \angle R \) and \( \angle X \)
   (b) \( PQ \) and \( ZY \), \( QR \) and \( YX \), \( RP \) and \( XZ \)

4. (a) \( \triangle ABC \sim \triangle FED \)
   (b) \( \triangle PQR \sim \triangle UST \) (or \( \triangle PQR \sim \triangle SUT \))

5. \( x = 50^\circ \), \( y = 70^\circ \)

6. \( p = 6 \), \( r = 9 \)

7. \( h = 48^\circ \), \( t = 90^\circ \)

8. \( m = 8 \), \( z = 7 \)

9. \( b = 16 \), \( q = 30^\circ \)

10. \( r = 60^\circ \), \( t = 30^\circ \), \( x = 5 \)

11. \( x = 15^\circ \), \( y = 4 \)

12. \( h = 19 \), \( k = 1 \)

13. \( r = 45^\circ \), \( z = 40^\circ \)

14. \( p = 4 \), \( x = 25^\circ \)

15. (a) 40° (b) 80° (c) 60°

16. (a) 65° (b) 7.5 cm

17. (a) 100° (b) 45° (c) 32 cm

18. 9.8

19. yes

20. \( NO = 12 \), \( SR = 10 \)
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11.4A Three Angles Equal (AAA)

If \( \angle A = \angle X, \angle B = \angle Y \) and \( \angle C = \angle Z \),
then \( \triangle ABC \sim \triangle XYZ \).

[Reference: AAA] "AAA" stands for 'Angle-Angle-Angle',
i.e. Three angles equal.

Example 1

Write down a pair of similar triangles in the figure and give reasons.

\[
\begin{align*}
\triangle PQR & \sim \triangle DEF \quad \text{(AAA)} \\
\angle P &= \angle D = 40^\circ, \angle Q = \angle E = 110^\circ, \\
\angle R &= \angle F = 30^\circ.
\end{align*}
\]

Instant Drill 1

Write down a pair of similar triangles in the figure and give reasons.

\[
\begin{align*}
\angle A &= ____ = 80^\circ, \angle B &= ____ = 55^\circ, \\
\angle C &= ____ = 45^\circ.
\end{align*}
\]

\( \triangle \sim \triangle \) ( )

1. Determine whether the two triangles below must be similar. If yes, give reasons.

2. Determine whether the two triangles below must be similar. If yes, give reasons.
11.4B Three Sides Proportional

If \( \frac{AB}{XY} = \frac{BC}{YZ} = \frac{CA}{ZX} \),

then \( \triangle ABC \sim \triangle XYZ \).

[Reference: 3 sides proportional]

\[ \begin{align*}
\text{Example 2} \\
\text{Determine whether the two triangles below must be similar. If yes, give reasons.}
\end{align*} \]

\[ \text{Sol} \]

\[ \begin{array}{|c|c|c|}
\hline
\triangle DEF & \triangle PQR & \text{Ratio of sides} \\
\hline
\text{Longest side} & 15 & 5 & \frac{15}{5} = 3 \\
\text{Second longest side} & 12 & 4 & \frac{12}{4} = 3 \\
\text{Shortest side} & 6 & 2 & \frac{6}{2} = 3 \\
\hline
\end{array} \]

Yes, \( \triangle DEF \sim \triangle PQR \) (3 sides proportional).

\[ \begin{align*}
\frac{DE}{PQ} &= \frac{15}{5} = 3 \\
\frac{EF}{QR} &= \frac{12}{4} = 3 \\
\frac{FD}{RP} &= \frac{6}{2} = 3
\end{align*} \]

\[ \text{Instant Drill 2} \]

\[ \text{Determine whether the two triangles below must be similar. If yes, give reasons.} \]

\[ \text{Sol} \]

<table>
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<tr>
<th>( \triangle XYZ )</th>
<th>( \triangle LMN )</th>
<th>Ratio of sides</th>
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</thead>
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<tr>
<td>Longest side</td>
<td>8</td>
<td>\frac{8}{16} = 0.5</td>
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<tr>
<td>Second longest side</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Shortest side</td>
<td>6</td>
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Mind the order of vertices when naming similar triangles.

3. Determine whether the two triangles below must be similar. If yes, give reasons.

4. Determine whether the two triangles below must be similar. If yes, give reasons.

\( \square \) Ex 11D 2, 6, 7
11.4C Two Sides Proportional and the Included Angle Equal

If \( \frac{AB}{XY} = \frac{BC}{YZ} \) and \( \angle B = \angle Y \),
then \( \triangle ABC \sim \triangle XYZ \).

[Reference: ratio of 2 sides, inc. \( \angle \)]

Example 3
Determine whether the two triangles below must be similar. If yes, give reasons.

Sol
Yes, \( \triangle PQR \sim \triangle STU \) (ratio of 2 sides, inc. \( \angle \)).

Instant Drill 3
Determine whether the two triangles below must be similar. If yes, give reasons.

Sol

5. Determine whether the two triangles below must be similar. If yes, give reasons.

6. Determine whether the two triangles below must be similar. If yes, give reasons.

\( \Theta \) Ex 11D 3, 5, 8
7. Determine which two triangles below must be similar and give reasons.

8. Refer to the figure.
   (a) Determine whether the two triangles must be similar. If yes, give reasons.
   (b) Is $EF$ perpendicular to $FG$? Explain your answer.

9. In the figure, $PQR$ is a straight line.
   (a) Write down a pair of similar triangles and give reasons.
   (b) Is $QT$ parallel to $RS$? Explain your answer.

Ex 11D 10–12
10. Refer to the figure.
   (a) Find $a$ and $b$.
   (b) Determine whether the two triangles must be similar. If yes, give reasons.

11. In the figure, $AEB$ and $ADC$ are straight lines.
   (a) Are $\triangle ABC$ and $\triangle ADE$ similar? If yes, give reasons.
   (b) Find $x$. 

II.4A Three Angles Equal (AAA)

If $\angle A = \angle X$, $\angle B = \angle Y$ and $\angle C = \angle Z$, then $\triangle ABC \sim \triangle XYZ$.

[Reference: AAA] 'AAA' stands for 'Angle-Angle-Angle', i.e. Three angles equal.

Example 1
Write down a pair of similar triangles in the figure and give reasons.

İsol: Find out three pairs of equal corresponding angles first.
$\angle P = \angle D = 40^\circ$, $\angle Q = \angle E = 110^\circ$, $\angle R = \angle F = 30^\circ$.

$\triangle PQR \sim \triangle DEF$ (AAA)

Mind the order of vertices when naming similar triangles.

Instant Drill 1
Write down a pair of similar triangles in the figure and give reasons.

İsol: $\angle A = ____ = 80^\circ$, $\angle B = ____ = 55^\circ$, $\angle C = ____ = 45^\circ$.

$\triangle ____ \sim \triangle ____$ (____)

1. Determine whether the two triangles below must be similar. If yes, give reasons.

2. Determine whether the two triangles below must be similar. If yes, give reasons.

Ex 11D 1, 4, 9
11.4B Three Sides Proportional

If \( \frac{AB}{XY} = \frac{BC}{YZ} = \frac{CA}{ZX} \),
then \( \triangle ABC \sim \triangle XYZ \).

[Reference: 3 sides proportional]

Example 2
Determine whether the two triangles below must be similar. If yes, give reasons.

\[ \triangle DEF \sim \triangle PQR \]

(3 sides proportional).

<table>
<thead>
<tr>
<th>( \triangle DEF )</th>
<th>( \triangle PQR )</th>
<th>Ratio of sides</th>
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<tbody>
<tr>
<td>Longest side</td>
<td>15</td>
<td>5</td>
</tr>
<tr>
<td>Second longest side</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td>Shortest side</td>
<td>6</td>
<td>2</td>
</tr>
</tbody>
</table>

Yes, \( \triangle DEF \sim \triangle PQR \)

\( \frac{DE}{PQ} = \frac{15}{5} = 3 \)
\( \frac{EF}{QR} = \frac{12}{4} = 3 \)
\( \frac{FD}{RP} = \frac{6}{2} = 3 \)

Instant Drill 2
Determine whether the two triangles below must be similar. If yes, give reasons.

\[ \triangle XYZ \sim \triangle LMN \]

Mind the order of vertices when naming similar triangles.

3. Determine whether the two triangles below must be similar. If yes, give reasons.

4. Determine whether the two triangles below must be similar. If yes, give reasons.

Ex 11D 2, 6, 7
11.4C Two Sides Proportional and the Included Angle Equal

If \( \frac{AB}{XY} = \frac{BC}{YZ} \) and \( \angle B = \angle Y \),
then \( \triangle ABC \sim \triangle XYZ \).

[Reference: ratio of 2 sides, inc. \( \angle \)]

**Example 3**
Determine whether the two triangles below must be similar. If yes, give reasons.

**Sol**
Yes, \( \triangle PQR \sim \triangle STU \)
(ratio of 2 sides, inc. \( \angle \)).

\[
\frac{PQ}{ST} = \frac{4}{8} = \frac{1}{2}, \quad \frac{QR}{TU} = \frac{6}{12} = \frac{1}{2}
\]

\[\angle Q = \angle T = 50^\circ\]

---

**Instant Drill 3**
Determine whether the two triangles below must be similar. If yes, give reasons.

**Sol**

---

5. Determine whether the two triangles below must be similar. If yes, give reasons.

6. Determine whether the two triangles below must be similar. If yes, give reasons.

\( \triangle ABC \sim \triangle XYZ \)

\[\angle B = \angle Y, \quad \frac{AB}{XY} = \frac{BC}{YZ}\]

\[\triangle PQR \sim \triangle STU \]

\(\angle Q = \angle T = 50^\circ\)

\[
\frac{PQ}{ST} = \frac{4}{8} = \frac{1}{2}, \quad \frac{QR}{TU} = \frac{6}{12} = \frac{1}{2}
\]

\(\angle L = \angle F\)

\[
\frac{LN}{DF} = \frac{6}{2} = \frac{3}{1}, \quad \frac{MN}{FE} = \frac{9}{3} = \frac{3}{1}\]

\(\triangle MNP \sim \triangle DEF\)

Ex 11D 3, 5, 8
7. Determine which two triangles below must be similar and give reasons.

\[ \begin{align*}
\triangle ABC & \quad \triangle DEF \\
A & \quad E & \quad I \\
B & \quad D & \quad J \\
C & \quad F & \quad K \\
8 & \quad 50^\circ & \quad 7.5 \\
10 & \quad & \\
50^\circ & \quad 6 & \quad 12 \\
\end{align*} \]

8. Refer to the figure.
   (a) Determine whether the two triangles must be similar. If yes, give reasons.
   (b) Is \( EF \) perpendicular to \( FG \)? Explain your answer.

9. In the figure, \( PQR \) is a straight line.
   (a) Write down a pair of similar triangles and give reasons.
   (b) Is \( QT \) parallel to \( RS \)? Explain your answer.

\[ \begin{align*}
\triangle ABC & \quad \triangle DEF \\
A & \quad E & \quad I \\
B & \quad D & \quad J \\
C & \quad F & \quad K \\
10 & \quad 12.5 & \quad 20 \\
7.5 & \quad 50^\circ & \quad 15 \\
9.6 & \quad 25 & \\
10 & \quad 6 & \quad 16 \\
\end{align*} \]
10. Refer to the figure.
   (a) Find $a$ and $b$.
   (b) Determine whether the two triangles must be similar. If yes, give reasons.

11. In the figure, $AEB$ and $ADC$ are straight lines.
   (a) Are $\triangle ABC$ and $\triangle ADE$ similar? If yes, give reasons.
   (b) Find $x$. 
11 Congruence and Similarity

Level 1

In each of the following, the two given triangles are similar. State the reasons for the similarity. [Nos. 1–4]

1. 

2. 

3. 

4. 

Determine whether each of the following pairs of triangles must be similar. If yes, give reasons. [Nos. 5–10]

5. 

6. 

7. 

8. 

9. 

10.
In each of the following figures, determine which two triangles must be similar and give reasons.  

**Nos. 11–13**

11.

![Three triangles with angles 78°, 52°, and 28°, 60°, 78°, and 60°, 52°, respectively.]

12.

![Three triangles with sides 8 cm and 12 cm, 5.5 cm and 7 cm, and 6 cm and 11 cm.]

13.

![Three triangles with sides 4 cm and 12 cm, 6 cm and 10.5 cm, and 5 cm and 3 cm.]

14. Refer to the figure.

(a) Name a pair of similar triangles and give reasons.

(b) Find x.

**Level 2**

In each of the following figures, write down a pair of similar triangles and give reasons.  

**Nos. 15–18**

15.

![Three triangles with sides 16, 10, and 8 cm.]

16.

![Three triangles with sides 64°, 102°, and 24°.]

84
18. \[ P \]
\[ Q \]
\[ R \]
\[ S \]
\[ T \]
\[ U \]
\[ V \]
\[ W \]
\[ X \]
\[ Y \]
\[ Z \]

19. In the figure, \( DHF \) is a straight line.

(a) Write down a pair of similar triangles and give reasons.

(b) Is \( HG \) perpendicular to \( FG \)? Explain your answer.

20. In the figure, \( ABC \) and \( AED \) are straight lines.

(a) Write down a pair of similar triangles and give reasons.

(b) Find \( BE \).

21. In the figure, \( PSR \) is a straight line.

(a) Are \( \triangle PQS \) and \( \triangle PRQ \) similar? If yes, give reasons.

(b) Express \( \angle SQR \) in terms of \( a \) and \( b \).

22. The figure shows a flagpole \( EB \) and a lamppost \( DC \). It is given that \( ABC \) and \( AED \) are straight lines.

(a) Are \( \triangle ABE \) and \( \triangle ACD \) similar? If yes, give reasons.

(b) Find the height of the lamppost.
Consolidation Exercise 11D

1. 3 sides proportional
2. AAA
3. \(\text{ratio of 2 sides, inc. } \angle\)
4. AAA
5. yes, \(\triangle ABC \sim \triangle DFE\) (ratio of 2 sides, inc. \(\angle\))
6. no
7. no
8. yes, \(\triangle UVW \sim \triangle XZY\) (3 sides proportional)
9. yes, \(\triangle ABC \sim \triangle QRP\) (ratio of 2 sides, inc. \(\angle\))
10. yes, \(\triangle DEF \sim \triangle SUT\) (AAA)
11. \(\triangle PQR \sim \triangle YXZ\) (AAA)
12. \(\triangle DEF \sim \triangle IHG\) (3 sides proportional)
13. \(\triangle JKL \sim \triangle QRP\) (ratio of 2 sides, inc. \(\angle\))
14. (a) \(\triangle DEF \sim \triangle TUS\) (AAA)
(b) 3
15. \(\triangle ABC \sim \triangle DCA\) (3 sides proportional)
16. \(\triangle PQR \sim \triangle TSR\) (AAA)
17. \(\triangle ABE \sim \triangle CBD\) (3 sides proportional)
18. \(\triangle PRT \sim \triangle QRS\) (ratio of 2 sides, inc. \(\angle\))
19. (a) \(\triangle DEF \sim \triangle FGH\) (3 sides proportional)
    (b) yes
20. (a) \(\triangle ABE \sim \triangle ACD\) (AAA)
    (b) 6 cm
21. (a) yes, ratio of 2 sides, inc. \(\angle\)
    (b) \(\angle SQR = 180^\circ - a - 2b\)
22. (a) yes, AAA
    (b) 6 m
<table>
<thead>
<tr>
<th>Date</th>
<th>Task</th>
<th>Progress</th>
<th>Teacher’s Signature</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lesson Worksheet</td>
<td>○ Complete and Checked ○ Problems encountered ○ Skipped</td>
<td>(Full Solution)</td>
</tr>
<tr>
<td></td>
<td>Consolidation Exercise</td>
<td>○ Complete and Checked ○ Problems encountered ○ Skipped</td>
<td>(Full Solution)</td>
</tr>
<tr>
<td></td>
<td>Maths Corner Exercise 12A Level 1</td>
<td>○ Complete and Checked ○ Problems encountered ○ Skipped</td>
<td>( )</td>
</tr>
<tr>
<td></td>
<td>Maths Corner Exercise 12A Level 2</td>
<td>○ Complete and Checked ○ Problems encountered ○ Skipped</td>
<td>( )</td>
</tr>
<tr>
<td></td>
<td>Maths Corner Exercise 12A Level 3</td>
<td>○ Complete and Checked ○ Problems encountered ○ Skipped</td>
<td>( )</td>
</tr>
<tr>
<td></td>
<td>Maths Corner Exercise 12A Multiple Choice</td>
<td>○ Complete and Checked ○ Problems encountered ○ Skipped</td>
<td>( )</td>
</tr>
<tr>
<td></td>
<td>E-Class Multiple Choice Self-Test</td>
<td>○ Complete and Checked ○ Problems encountered ○ Skipped</td>
<td>Mark: ________</td>
</tr>
</tbody>
</table>
12.1 Different Stages of Statistics

1. Miss Cheng wants to know the most favourite subject of a class of students. Write down the correct order for the following stages of statistics.
   I. Use a bar chart to present the data.
   II. Write a conclusion after interpreting the bar chart constructed.
   III. Prepare a questionnaire to collect the data about the most favourite subject of each student.
   IV. Use a table to list the number of students for each subject.

12.2A Collection of Data

(a) We should decide how to collect data according to our objectives.
(b) Common ways to collect data:
   - questionnaire, interview, observation, experiment, previous information

<table>
<thead>
<tr>
<th>Example 1</th>
<th>Instant Drill 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suggest a suitable way to collect data for each of the following.</td>
<td>Suggest a suitable way to collect data for each of the following.</td>
</tr>
<tr>
<td>(a) The total number of passengers of MTR last year</td>
<td>(a) The concentration of lead in drinking water of each household</td>
</tr>
<tr>
<td>(b) Public’s views on the increase in the price of electricity</td>
<td>(b) The usage of three cross harbour tunnels</td>
</tr>
<tr>
<td>Sol (a) The data can be collected by previous information.</td>
<td>Sol (a) The data can be collected by __________________.</td>
</tr>
<tr>
<td>(b) The data can be collected by questionnaires.</td>
<td>(b) The data can be collected by __________________.</td>
</tr>
</tbody>
</table>

For part (b), can you give other suggestions?

2. Suggest a suitable way to collect data for each of the following.
   (a) The lifespan of a certain brand of electric cooker
   (b) The opinions of audience on a TV programme
   (c) The food energy produced by a breakfast set in a restaurant
   (d) The number of black rainstorm signals issued in Hong Kong last year
   (e) The customer count of a shopping mall last month
12.2B Classification of Data

(a) Discrete data: Can only take up specific values, and usually obtained from direct counting. e.g. The number of people in a swimming pool

(b) Continuous data: Can take up any value within a certain range, and usually obtained from measurements. e.g. The daily study time of a class of students

3. Determine whether the following are discrete data or continuous data. Put a ‘✓’ in the appropriate box.

<table>
<thead>
<tr>
<th></th>
<th>Discrete data</th>
<th>Continuous data</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>(a)</strong></td>
<td>The monthly rainfall of a city last year</td>
<td></td>
</tr>
<tr>
<td><strong>(b)</strong></td>
<td>The number of times that each student in a class fails to submit homework last month</td>
<td></td>
</tr>
<tr>
<td><strong>(c)</strong></td>
<td>The number of car parks in each district</td>
<td></td>
</tr>
<tr>
<td><strong>(d)</strong></td>
<td>The numbers of different kinds of pens produced by a factory last year</td>
<td></td>
</tr>
<tr>
<td><strong>(e)</strong></td>
<td>The daily time spent on using smartphones by each family member</td>
<td></td>
</tr>
<tr>
<td><strong>(f)</strong></td>
<td>The weight of a carry-on baggage of each passenger on a flight</td>
<td></td>
</tr>
</tbody>
</table>

4. Mr Lam wants to know the number of working days of each part-time staff last month.
   (a) Suggest a suitable way for Mr Lam to collect the data.
   (b) Are the data collected discrete or continuous?

‘Explain Your Answer’ Question

5. A magazine editor wants to report the feeling of a Hong Kong athlete who won a medal in the Olympic Game recently. The editor plans to obtain the information in details by questionnaire.
   (a) Do you think this is a suitable way to collect data? Explain your answer.
   (b) Suggest a more suitable way to collect the data.

Level Up Question

6. The class committee conducts a survey on the time spent by each student in the study room this week.
   (a) Are the data collected discrete or continuous?
   (b) The chairman plans to send students to collect the data by direct observation. Write down one advantage and one disadvantage of this way of collecting data.
12 Introduction to Statistics

Level 1

1. Suggest a suitable way to collect data for each of the following.
   (a) The monthly rainfalls in Hong Kong last year
   (b) The ingredients of different chemicals
   (c) The monthly expenses of some students on transportation
   (d) The lifetimes of different brands of mobile phones
   (e) The popularity of different brands of milk powder for newborn babies
   (f) The numbers of visitors to different swimming pools at a particular period of time

2. Determine whether the following are discrete data or continuous data.
   (a) The numbers of bookshelves in some libraries
   (b) The heights of trees in a garden
   (c) The daily sales volume of hamburgers of a fast food restaurant in a month
   (d) The distances of a bookstore from different exits of an MTR station
   (e) The daily working time of each employee in a company
   (f) The number of sunny days in each month in the past three years

3. An environmental organization wants to know the weights of pollutants in the sewage discharged by 20 factories.
   (a) Suggest a suitable way for the organization to collect the data.
   (b) Are the data collected discrete or continuous?

4. Joe conducts a survey to find out the numbers of books read by his friends during summer holidays.
   (a) How should the survey be conducted in order to collect the required data?
   (b) Are the data collected discrete or continuous?

5. A student wants to investigate how many private cars use certain roads at a particular time.
   (a) Suggest a suitable way for the student to collect data.
   (b) Are the data collected discrete or continuous?
6. Mr Cheung wants to know the average temperature of a city in each month last year.
   (a) Suggest a suitable way for Mr Cheung to collect data.
   (b) Are the data collected discrete or continuous?

7. A factory manager conducts a survey to collect opinions from the public on the products made by the factory. Write down an advantage and a disadvantage of using each of the following ways to collect the data.
   (a) Questionnaire
   (b) Interview

8. A company wants to conduct a survey on the shopping habits of customers.
   (a) Give an example of continuous data which is relevant to the survey.
   (b) Give an example of discrete data which is relevant to the survey.

9. A scientist wants to study the stray dog problem in a city. He needs to obtain the two sets of data below.
   - Set 1: The number of stray dogs in the city in each of the past ten years
   - Set 2: The public attitude towards stray dogs

   (a) Suggest a suitable way for the scientist to collect data of
      (i) Set 1,
      (ii) Set 2.
   (b) A student thinks that all the data collected in (a) are discrete data. Do you agree? Explain your answer.

10. Jack wants to know the weights of schoolbags of a group of 100 students.
    (a) Jack weighs every student’s schoolbag in the group. Write down a disadvantage of this way of collecting data.
    (b) Are the data collected in (a) discrete or continuous?

    Later, Jack finds that the weights of the 100 students were recorded last year. He then uses these records and the data collected in (a) to investigate whether the schoolbags are overweight. Is it appropriate to do the investigation in such way? Explain your answer.
Consolidation Exercise 12A (Answer)

1. (a) previous information  
   (b) experiment  
   (c) questionnaire or interview  
   (d) experiment  
   (e) questionnaire or interview  
   (f) observation

2. (a) discrete data  
   (b) continuous data  
   (c) discrete data  
   (d) continuous data  
   (e) continuous data  
   (f) discrete data

3. (a) experiment

4. (a) questionnaire or interview  
   (b) discrete data

5. (a) observation  
   (b) discrete data

6. (a) previous information  
   (b) continuous data

9. (a) (i) previous information  
    (ii) questionnaire or interview  
    (b) no

10. (b) continuous data  
    (c) no
| Date | Task                        | Progress                  |  |
|------|-----------------------------|---------------------------|  |
|      | Lesson Worksheet            | ○ Complete and Checked    |  |
|      |                             | ○ Problems encountered    |  |
|      |                             | ○ Skipped                 |  |
|      | Book Example 1              | ○ Complete                |  |
|      |                             | ○ Problems encountered    |  |
|      |                             | ○ Skipped                 |  |
|      | Book Example 2              | ○ Complete                |  |
|      |                             | ○ Problems encountered    |  |
|      |                             | ○ Skipped                 |  |
|      | Consolidation Exercise      | ○ Complete and Checked    |  |
|      |                             | ○ Problems encountered    |  |
|      |                             | ○ Skipped                 |  |
|      | Maths Corner Exercise 12B Level 1 | ○ Complete and Checked  |  |
|      |                             | ○ Problems encountered    |  |
|      |                             | ○ Skipped                 |  |
|      | Maths Corner Exercise 12B Level 2 | ○ Complete and Checked  |  |
|      |                             | ○ Problems encountered    |  |
|      |                             | ○ Skipped                 |  |
|      | Maths Corner Exercise 12B Level 3 | ○ Complete and Checked  |  |
|      |                             | ○ Problems encountered    |  |
|      |                             | ○ Skipped                 |  |
|      | Maths Corner Exercise 12B Multiple Choice | ○ Complete and Checked  |  |
|      |                             | ○ Problems encountered    |  |
|      |                             | ○ Skipped                 |  |
|      | E-Class Multiple Choice Self-Test | ○ Complete and Checked  |  |
|      |                             | ○ Problems encountered    |  |
|      |                             | ○ Skipped                 |  |
|      |                             | Teacher’s Signature | (         )  |
|      |                             | Mark:                     |   |
12.3 Organization of Data

We can organize the collected data by a **frequency distribution table**.

**Example 1**
Listed below are the ages of 21 children.

5 4 7 5 6 4 5
7 5 7 7 7 6 6
6 5 5 5 7 7 7

Construct a frequency distribution table for the above data.

**Sol**

**Step 1**: Write down all the numbers appeared in the data.

**Step 2**: Go over the data one by one. Whenever a number, say ‘4’, appears, one tally ‘/’ is marked in the box for ‘4’. So, ‘//’ means that the data has appeared 5 times.

**Step 3**: Write down the frequency according to the tallies.

<table>
<thead>
<tr>
<th>Age</th>
<th>Tally</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>/</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>/////</td>
<td>7</td>
</tr>
<tr>
<td>6</td>
<td>/////</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>/////</td>
<td>8</td>
</tr>
</tbody>
</table>

**Instant Drill 1**
Listed below are the numbers of times that 21 students used the computer room last month.

0 0 3 1 0 2 0
1 0 1 0 0 1 3
0 0 1 2 0 1 2

Construct a frequency distribution table for the above data.

**Sol**

<table>
<thead>
<tr>
<th>Number of times</th>
<th>Tally</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Listed below are the numbers of smartphones owned by 18 citizens.

1 3 2 3 2 4 0 1 2 3 1 1 2 2 3 4 3 3

(a) Construct a frequency distribution table for the above data.

(b) Find the number of citizens who have owned not less than 3 smartphones.

(a) **Number of smartphones**

<table>
<thead>
<tr>
<th>Tally</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

(b) The required number of citizens =

Refer to the frequencies for 3 and ____ smartphones.

Ex 12B 1, 2
Example 2
Listed below are the daily emails received by Mr Chan in the past 30 days.

- 8 12 6 9 1 5
- 5 7 3 13 12 4
- 9 8 15 7 6 19
- 9 2 16 10 6 7
- 7 9 5 11 4 18

Construct a frequency distribution table by dividing the above data into groups: 1–5, 6–10, 11–15 and 16–20.

<table>
<thead>
<tr>
<th>Number of emails</th>
<th>Tally</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1–5</td>
<td>###</td>
<td>8</td>
</tr>
<tr>
<td>6–10</td>
<td>####/</td>
<td>14</td>
</tr>
<tr>
<td>11–15</td>
<td>##</td>
<td>5</td>
</tr>
<tr>
<td>16–20</td>
<td>///</td>
<td>3</td>
</tr>
</tbody>
</table>

Can you find out the following by observation?
(a) The first group should include the smallest datum ‘1’, and the last group should include the largest datum ‘19’.
(b) The groups should not overlap. E.g. The data cannot be divided into groups 1–5, 5–9, etc.
(c) The groups should have an equal width of range. E.g. The data cannot be divided into groups 1–4, 5–10, etc.

Instant Drill 2
Listed below are the marks of a group of 24 students in a quiz.

- 15 16 20 12 7 23
- 11 23 18 8 25 19
- 19 20 17 13 22 18
- 9 11 12 14 18 24

Construct a frequency distribution table by dividing the above data into groups: 6–10, 11–15, 16–20 and 21–25.

<table>
<thead>
<tr>
<th>Marks</th>
<th>Tally</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>6–10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11–15</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Listed below are the daily highest air temperatures (in °C) in a city in the past two weeks.

- 32 36 25 28 39 33 28
- 30 29 29 32 35 37 33

Construct a frequency distribution table by dividing the above data into groups: 25 °C–28 °C, 29 °C–32 °C, 33 °C–36 °C and 37 °C–40 °C.

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>Tally</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>25–28</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. Listed below are the lunch expenses (in $) of Miss Wong in the past 24 days.

- 42 40 35 24 28 63 41 60
- 29 25 22 45 66 46 50 47
- 53 25 30 45 38 42 67 39

Construct a frequency distribution table by dividing the above data into groups: $21–$30, $31–$40, $41–$50, etc.

<table>
<thead>
<tr>
<th>Expense ($)</th>
<th>Tally</th>
<th>Frequency</th>
</tr>
</thead>
</table>

 Emblem Ex 12B 3–5
### ‘Explain Your Answer’ Question

4. Listed below are the numbers of late days of 30 employees in a company last year.

   0  3  2  1  0  0  1  4  3  4
   1  0  0  1  5  8  0 10  1  2
   3  5  0  9  1  6  0  1  2  7

   (a) Construct a frequency distribution table by dividing the above data into groups: 0–2, 3–5, 6–8, etc.

   (b) An employee with less than 3 late days last year will receive a bonus. Kelly claims that more than 20 employees will receive the bonus. Do you agree? Explain your answer.

   

<table>
<thead>
<tr>
<th>Number of late days</th>
<th>Tally</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

   (b) Number of employees with less than 3 late days last year

   =

   

   ∴ (> / = / <) 20

   

   ∴ The claim is (agreed / disagreed).

### Level Up Question

5. Sam interviewed 40 people about their daily travel expenses (in $). The results are as follows.

   18  12  11  10  16  18  15  14  9  20
   11  16  8  31  21  24  8  14  28  24
   23  16  9  13  15  8  21  17  14  22
   31  29  22  17  19  20  18  16  23  26

   (a) Construct a frequency distribution table by dividing the above data into groups: $8–$12, $13–$17, $18–$22, etc.

   (b) Which group of data has the highest frequency? Which group of data has the lowest frequency?

   (c) Find the percentage of people whose daily travel expenses are more than $27.
12 Introduction to Statistics

Consolidation Exercise 12B

Level 1

1. The following shows the data about the favourite pets of 30 girls.

<table>
<thead>
<tr>
<th>Favourite pet</th>
<th>Tally</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dog</td>
<td>//</td>
<td></td>
</tr>
<tr>
<td>Rabbit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fish</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bird</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turtle</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Complete the frequency distribution table below for the given data.

2. Listed below are the ages of the students in a class.

12 12 13 12 13 11 12 12 12
13 13 11 13 12 12 14 12 13
11 13 12 12 12 14 13 13 11

(a) Construct a frequency distribution table for the above data.
(b) Find the number of students whose ages are under 13.

3. Listed below are the numbers of phone calls received by an office in the past 40 weeks.

68 71 78 75 92 83 82 89 77 73
77 79 78 81 88 72 84 69 82 81
94 76 73 82 86 87 79 78 81 70
66 80 77 73 82 78 88 86 92 87

Construct a frequency distribution table by dividing the above data into groups: 66–70, 71–75, 76–80, 81–85, 86–90 and 91–95.
4. Listed below are the heights (in m) of some trees in a forest.

15.1 15.3 15.7 14.8 16.2 15.5 15.2 16.1 15.0 15.9
16.7 15.1 15.2 15.7 16.3 14.6 15.8 16.2 15.3 15.6

Construct a frequency distribution table by dividing the above data into groups:
14.5 m–14.9 m, 15.0 m–15.4 m, 15.5 m–15.9 m, etc.

5. Listed below are the numbers of mistakes made by 27 students in a test.

1 0 0 5 2 21 0 1 7
0 15 4 9 12 0 0 0 6
16 7 0 6 1 0 17 12 5

Construct a frequency distribution table by dividing the above data into groups:
0–4, 5–9, 10–14, etc.

6. The following table shows the grades obtained by a group of students in an examination.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Tally</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>/////</td>
<td>4</td>
</tr>
<tr>
<td>B</td>
<td>###</td>
<td>5</td>
</tr>
<tr>
<td>C</td>
<td>###</td>
<td>5</td>
</tr>
<tr>
<td>D</td>
<td>### ///</td>
<td>8</td>
</tr>
<tr>
<td>E</td>
<td>### ### ### ///</td>
<td>18</td>
</tr>
</tbody>
</table>

(a) How many students are there in the group?
(b) Do most students in the group obtain good results? Explain your answer.

Level 2
7. The following shows the time (in min) spent by some children on reading story books on a day.

33 24 48 15 35 36 25 40 45 20
55 52 32 24 22 5 60 30 34 46
12 25 24 56 35 36 27 44 35 50

(a) Construct a frequency distribution table by dividing the above data into groups:
1 min–10 min, 11 min–20 min, 21 min–30 min, etc.
(b) Find the percentage of the children who spend more than 30 min on reading story books on that day.
8. In a quality test, the numbers of tasks finished by some machines within an hour are recorded:

\[
\begin{array}{cccccccc}
2 & 0 & 6 & 8 & 1 & 0 & 5 & 12 & 7 & 5 \\
11 & 10 & 0 & 7 & 16 & 6 & 13 & 0 & 0 & 5 \\
0 & 6 & 21 & 6 & 15 & 12 & 12 & 7 & 5 & 18 \\
\end{array}
\]

(a) Convert the above data into grades according to the table below.

<table>
<thead>
<tr>
<th>Number of tasks finished within an hour</th>
<th>20–24</th>
<th>15–19</th>
<th>10–14</th>
<th>5–9</th>
<th>0–4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
</tr>
</tbody>
</table>

(b) Construct a frequency distribution table showing the grades given to the machines in (a).

(c) If the grade given to a machine is D or E, the machine fails in the quality test. Find the percentage of the machines that fail in the quality test.

9. Listed below are the daily sales of a boutique in March.

\[
\begin{array}{cccccccccccccccc}
33 & 37 & 26 & 28 & 42 & 43 & 32 & 34 & 34 & 32 & 38 & 41 & 49 & 37 & 36 & 44 \\
45 & 37 & 27 & 31 & 48 & 32 & 35 & 38 & 33 & 37 & 26 & 28 & 42 & 43 & 32 & 34 \\
\end{array}
\]

(a) Construct a frequency distribution table by dividing the above data into groups:

\[
\begin{array}{cccccccccccc}
/// & /// & /// & /// & /// & /// \\
2 & 3 & 6 & 8 & 5 & 0 \\
\end{array}
\]

(b) In April, the boutique started a promotion programme in order to increase the sales. The table below shows the daily sales in April.

<table>
<thead>
<tr>
<th>Daily sale</th>
<th>Tally</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>31–35</td>
<td>///</td>
<td>2</td>
</tr>
<tr>
<td>36–40</td>
<td>///</td>
<td>3</td>
</tr>
<tr>
<td>41–45</td>
<td>///</td>
<td>6</td>
</tr>
<tr>
<td>46–50</td>
<td>///</td>
<td>8</td>
</tr>
<tr>
<td>51–55</td>
<td>///</td>
<td>5</td>
</tr>
</tbody>
</table>

Do you think that the promotion programme is useful? Explain your answer.

10. Listed below are the numbers of foggy days in 27 cities last month.

\[
\begin{array}{cccccccccccccccc}
6 & 6 & 1 & 4 & 7 & 8 & 12 & 3 & 10 \\
16 & 7 & 9 & 13 & 2 & 4 & 6 & 5 & 11 \\
0 & 12 & 7 & 8 & 18 & 5 & 2 & 22 & 6 \\
\end{array}
\]

(a) A student organizes the above data in a frequency distribution table shown below.

<table>
<thead>
<tr>
<th>Number of foggy days</th>
<th>Tally</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–10</td>
<td>///</td>
<td>20</td>
</tr>
<tr>
<td>10–25</td>
<td>///</td>
<td>8</td>
</tr>
</tbody>
</table>

Are the data organized properly by the student? Explain your answer.

(b) Construct a frequency distribution table by dividing the data into a suitable number of groups.
Consolidation Exercise 12B

1. | Favourite pet | Tally | Frequency |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Dog</td>
<td>### /</td>
<td>7</td>
</tr>
<tr>
<td>Rabbit</td>
<td>### ///</td>
<td>8</td>
</tr>
<tr>
<td>Fish</td>
<td>###</td>
<td>5</td>
</tr>
<tr>
<td>Bird</td>
<td>### /</td>
<td>6</td>
</tr>
<tr>
<td>Turtle</td>
<td>///</td>
<td>4</td>
</tr>
</tbody>
</table>

2. (a) | Age | Tally | Frequency |
       |-----|-------|-----------|
       | 11  | ///   | 4         |
       | 12  | ### /// | 12       |
       | 13  | ### ////// | 9       |
       | 14  | ///   | 2         |
(b) 16

3. | Number of phone calls | Tally | Frequency |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>66–70</td>
<td>///</td>
<td>4</td>
</tr>
<tr>
<td>71–75</td>
<td>### /</td>
<td>6</td>
</tr>
<tr>
<td>76–80</td>
<td>### ///</td>
<td>11</td>
</tr>
<tr>
<td>81–85</td>
<td>### //////</td>
<td>9</td>
</tr>
<tr>
<td>86–90</td>
<td>///</td>
<td>7</td>
</tr>
<tr>
<td>91–95</td>
<td>///</td>
<td>3</td>
</tr>
</tbody>
</table>

4. | Height of a tree (m) | Tally | Frequency |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>14.5–14.9</td>
<td>//</td>
<td>2</td>
</tr>
<tr>
<td>15.0–15.4</td>
<td>### ///</td>
<td>7</td>
</tr>
<tr>
<td>15.5–15.9</td>
<td>### /</td>
<td>6</td>
</tr>
<tr>
<td>16.0–16.4</td>
<td>//////</td>
<td>4</td>
</tr>
<tr>
<td>16.5–16.9</td>
<td>//</td>
<td>1</td>
</tr>
</tbody>
</table>

5. | Number of mistakes | Tally | Frequency |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0–4</td>
<td>### ///</td>
<td>14</td>
</tr>
<tr>
<td>5–9</td>
<td>### /</td>
<td>7</td>
</tr>
<tr>
<td>10–14</td>
<td>//</td>
<td>2</td>
</tr>
<tr>
<td>15–19</td>
<td>///</td>
<td>3</td>
</tr>
<tr>
<td>20–24</td>
<td>//</td>
<td>1</td>
</tr>
</tbody>
</table>

6. (a) 40 (b) no

7. (a) | Time spent on reading story books (min) | Tally | Frequency |
        |----------------------------------------|-------|-----------|
        | 1–10                                  | /     | 1         |
        | 11–20                                 | ///   | 3         |
        | 21–30                                 | ### /// | 8       |
        | 31–40                                 | ### ////// | 9       |
        | 41–50                                 | ### | 5         |
        | 51–60                                 | ////// | 4         |
(b) 60%

8. (b) | Grade | Tally | Frequency |
      |-------|-------|-----------|
      | A     | /     | 1         |
      | B     | ///   | 3         |
      | C     | ### / | 6         |
      | D     | ### /// | 12       |
      | E     | ### ////// | 8       |
(c) 66\frac{2}{3}%

9. (a) | Daily sale | Tally | Frequency |
      |------------|-------|-----------|
      | 26–30      | ///   | 3         |
      | 31–35      | ### /// | 8       |
      | 36–40      | ### / | 6         |
      | 41–45      | /// | 5         |
      | 46–50      | //   | 2         |
(b) yes

10. (a) No. The number of groups is too small. The groups overlap each other. The width of the range of each group is not equal.

(b) | Number of foggy days | Tally | Frequency |
     |----------------------|-------|-----------|
     | 0–4                  | ///   | 7         |
     | 5–9                  | ### /// | 12       |
     | 10–14                | ///   | 12       |
     | 15–19                | /// | 2         |
     | 20–24                | /     | 1         |
(or other reasonable answers)
## F1B: Chapter 12C

<table>
<thead>
<tr>
<th>Date</th>
<th>Task</th>
<th>Progress</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lesson Worksheet</td>
<td>Complete and Checked ○ Problems encountered ○ Skipped</td>
</tr>
<tr>
<td></td>
<td>Book Example 3</td>
<td>Complete ○ Problems encountered ○ Skipped</td>
</tr>
<tr>
<td></td>
<td>Book Example 4</td>
<td>Complete ○ Problems encountered ○ Skipped</td>
</tr>
<tr>
<td></td>
<td>Book Example 5</td>
<td>Complete ○ Problems encountered ○ Skipped</td>
</tr>
<tr>
<td></td>
<td>Book Example 6</td>
<td>Complete ○ Problems encountered ○ Skipped</td>
</tr>
<tr>
<td></td>
<td>Book Example 7</td>
<td>Complete ○ Problems encountered ○ Skipped</td>
</tr>
<tr>
<td></td>
<td>Book Example 8</td>
<td>Complete ○ Problems encountered ○ Skipped</td>
</tr>
<tr>
<td></td>
<td>Consolidation Exercise</td>
<td>Complete and Checked ○ Problems encountered ○ Skipped</td>
</tr>
<tr>
<td></td>
<td>Maths Corner Exercise 12C Level 1</td>
<td>Complete and Checked ○ Problems encountered</td>
</tr>
</tbody>
</table>

Teacher’s Signature: _______ ( )
<table>
<thead>
<tr>
<th></th>
<th>Skipped</th>
<th>Complete and Checked</th>
<th>Problems encountered</th>
<th>Teacher’s Signature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maths Corner Exercise</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12C Level 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maths Corner Exercise</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12C Level 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maths Corner Exercise</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12C Multiple Choice</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E-Class Multiple Choice</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-Test</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Mark: 

Mark:

Mark:
12.4A Pie Charts

(a) A pie chart can show the portion of each item compared with the whole set of data.

(b) In a pie chart, each sector represents an item, where

\[ \text{angle of sector} = 360^\circ \times \text{percentage of an item} \]

or

\[ \text{angle of sector} = 360^\circ \times \frac{\text{frequency of an item}}{\text{total frequency of all items}} \]

1. The table below shows the favourite subjects of 10 students.

<table>
<thead>
<tr>
<th>Subject</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chinese Language</td>
<td>2</td>
</tr>
<tr>
<td>English Language</td>
<td>1</td>
</tr>
<tr>
<td>Mathematics</td>
<td>4</td>
</tr>
<tr>
<td>Liberal Studies</td>
<td>3</td>
</tr>
</tbody>
</table>

Follow the steps below to complete the pie chart.

**Step 1:** Find the angle of sector representing each item and complete the table below.

<table>
<thead>
<tr>
<th>Subject</th>
<th>Percentage of the whole</th>
<th>Angle of sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chinese Language</td>
<td>( \frac{2}{10} \times 100% = 20% )</td>
<td>( 360^\circ \times 20% = 72^\circ )</td>
</tr>
<tr>
<td>English Language</td>
<td>( \frac{1}{10} \times 100% = )</td>
<td>( 360^\circ \times (\quad) = )</td>
</tr>
<tr>
<td>Mathematics</td>
<td>( \frac{4}{10} \times 100% = )</td>
<td></td>
</tr>
<tr>
<td>Liberal Studies</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Step 2:** Consider the circle on the right.

Based on the results of **Step 1**,   
(i) divide the circle into sectors;  
(ii) label the item represented by each sector;  
(iii) indicate the angle of sector.  
[The sector representing ‘Chinese Language’ has been drawn as an example.]

**Step 3:** Give a title to the pie chart.
**Example 1**
The table below shows the blood types of a group of students.

<table>
<thead>
<tr>
<th>Blood type</th>
<th>O</th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>10</td>
<td>3</td>
<td>7</td>
</tr>
</tbody>
</table>

Construct a pie chart to show the distribution of the above data and indicate each item as an angle of sector.

**Sol**

Total frequency = $10 + 3 + 7 = 20$

<table>
<thead>
<tr>
<th>Blood type</th>
<th>Percentage of the whole</th>
<th>Angle of sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>O</td>
<td>$\frac{10}{20} \times 100%$</td>
<td>$360^\circ \times 50%$</td>
</tr>
<tr>
<td></td>
<td>$= 50%$</td>
<td>$= 180^\circ$</td>
</tr>
<tr>
<td>A</td>
<td>$\frac{3}{20} \times 100%$</td>
<td>$360^\circ \times 15%$</td>
</tr>
<tr>
<td></td>
<td>$= 15%$</td>
<td>$= 54^\circ$</td>
</tr>
<tr>
<td>B</td>
<td>$\frac{7}{20} \times 100%$</td>
<td>$360^\circ \times 35%$</td>
</tr>
<tr>
<td></td>
<td>$= 35%$</td>
<td>$= 126^\circ$</td>
</tr>
</tbody>
</table>

**Instant Drill 1**
The table below shows the class allocation of a group of students.

<table>
<thead>
<tr>
<th>Class</th>
<th>1A</th>
<th>1B</th>
<th>1C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>8</td>
<td>16</td>
<td>8</td>
</tr>
</tbody>
</table>

Construct a pie chart to show the distribution of the above data and indicate each item as an angle of sector.

**Sol**

Total frequency =

<table>
<thead>
<tr>
<th>Class</th>
<th>Percentage of the whole</th>
<th>Angle of sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A</td>
<td>$\frac{8}{\phantom{000}000} \times 100%$</td>
<td>$360^\circ \times \phantom{000}0%$</td>
</tr>
<tr>
<td></td>
<td>( )</td>
<td>=</td>
</tr>
<tr>
<td>1B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1C</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. The table below shows the favourite seasons of 30 teachers.

<table>
<thead>
<tr>
<th>Season</th>
<th>Spring</th>
<th>Summer</th>
<th>Autumn</th>
<th>Winter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>3</td>
<td>18</td>
<td>6</td>
<td>3</td>
</tr>
</tbody>
</table>

(a) Complete the table below.

<table>
<thead>
<tr>
<th>Season</th>
<th>Percentage of the whole</th>
<th>Angle of sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Summer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Autumn</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Winter</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(b) Construct a pie chart to show the distribution of the above data and indicate each item as a **percentage**.
Example 2

Types of fruits

<table>
<thead>
<tr>
<th>Type</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apple</td>
<td>50%</td>
</tr>
<tr>
<td>Banana</td>
<td>30%</td>
</tr>
<tr>
<td>Pear</td>
<td>y%</td>
</tr>
</tbody>
</table>

The pie chart above shows the types of 200 fruits in a shop.

(a) Find the number of apples in the shop.
(b) Find the percentage of pears.
(c) Find y.

Sol (a) Number of apples
      = 200 × 50%
      = 100

(b) The required percentage
     = (100 – 50 – 30)%
     = 20%

(c) y = 360° × 20%
    = 72°

Instant Drill 2

Time allocation of Tim yesterday

<table>
<thead>
<tr>
<th>Activity</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sleeping</td>
<td>37.5%</td>
</tr>
<tr>
<td>Studying</td>
<td>25%</td>
</tr>
<tr>
<td>Others</td>
<td>?%</td>
</tr>
<tr>
<td>Watching TV</td>
<td>?%</td>
</tr>
</tbody>
</table>

The pie chart above shows the time allocation of Tim yesterday.

(a) How many hours did Tim sleep yesterday?
(b) Find the percentage of time spent on watching TV.
(c) Find the angle of sector representing ‘Watching TV’.

Sol (a) Number of hours that Tim slept
      = (      ) × (      )% < There are ______ hours in a day.

(b) The required percentage
     =

(c) The required angle of sector
    =

3. The pie chart on the right shows the means of transports used by 180 students to go to school.
   (a) Find x.
   (b) Find the percentage of students who go to school by MTR.
   (c) Find the number of students who go to school by minibus.

Means of transports used by 180 students to go to school

<table>
<thead>
<tr>
<th>Mode</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bus</td>
<td>45%</td>
</tr>
<tr>
<td>MTR</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td></td>
</tr>
</tbody>
</table>

Ex 12C 4–6
12.4B Broken Line Graphs

A broken line graph is used to show how the frequency of an item changes over a period of time. It helps us observe the trend and make predictions.

4. The table below shows the numbers of players in the tennis team of a school from 2011 to 2015.

<table>
<thead>
<tr>
<th>Year</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of players</td>
<td>2</td>
<td>4</td>
<td>4</td>
<td>8</td>
<td>10</td>
</tr>
</tbody>
</table>

Follow the steps below to complete the broken line graph.

**Step ①:** Draw the scales on the horizontal and vertical axes. Then, label the two axes. Usually, the horizontal axis represents time (i.e. ‘Year’ in the table); the vertical axis represents the frequency of an item (i.e. ‘Number of players’ in the table).

**Step ②:** Use a ‘×’ to indicate the point representing a datum.

**Step ③:** Join adjacent points (‘×’s in Step ②) by line segments.

**Step ④:** Give a title to the broken line graph.
Example 3
The table below shows the conduct performance of Sara from 2012 to 2014.

<table>
<thead>
<tr>
<th>Year</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marks</td>
<td>80</td>
<td>60</td>
<td>50</td>
</tr>
</tbody>
</table>

Construct a broken line graph to present the above data.

Sol

![Image of a broken line graph showing conduct performance of Sara from 2012 to 2014.]

The symbol ‘-’ indicates that a part of the vertical axis is omitted.

Instant Drill 3
The table below shows the monthly salaries of Mabel from January to March.

<table>
<thead>
<tr>
<th>Month</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salary (thousand dollars)</td>
<td>7.4</td>
<td>7.6</td>
<td>8</td>
</tr>
</tbody>
</table>

Construct a broken line graph to present the above data.

Sol

![Image of a broken line graph showing monthly salaries of Mabel from January to March.]

5. The table below shows the numbers of refrigerators sold by a company from 2010 to 2015.

<table>
<thead>
<tr>
<th>Year</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of refrigerators</td>
<td>300</td>
<td>350</td>
<td>320</td>
<td>360</td>
<td>440</td>
<td>480</td>
</tr>
</tbody>
</table>

Construct a broken line graph to present the above data.

![Image of a broken line graph showing numbers of refrigerators sold by a company from 2010 to 2015.]

According to the broken line graph, can you predict the trend of the sales volume of refrigerators?

Ex 12C 7, 8
Example 4

The broken line graph above shows the sales amounts of a company in the first half year.

(a) Find the difference in sales amount between March and May.
(b) Between which two successive months did the sales amount decrease the most?
(c) Describe the trend of the sales amount in the first half year.

Sol

Sales amount in March = $194 000
Sales amount in May = $180 000

Difference in sales amount between March and May
= $(194 000 – 180 000)
= $14 000

(b) The steeper the downward line segment, the greater the decrease.

From the graph, the sales amount decreased the most from May to June.

(c) The sales amount of the company decreased gradually in the first half year.

Instant Drill 4

The broken line graph above shows the daily average air temperatures of a city last week.

(a) Find the difference in average air temperature between Monday and Thursday.
(b) Between which two successive days did the average air temperature increase the most?
(c) Describe the trend of air temperature last week.

Sol

Monday: ___ °C
Thursday: ___ °C

Difference in average air temperature between Monday and Thursday
= ___ °C

(b) From the graph, the average air temperature increased the most from ___ to ___.

The steeper the upward line segment, the greater the increase.

(c) The air temperature of the city ___ last week.
6. The broken line graph on the right shows the numbers of new members of a fitness centre from 2009 to 2015.  
(a) Find the total number of new members from 2009 to 2015.
(b) Describe the trend of the number of new members of the fitness centre from 2009 to 2015.

(a) From the graph, we have

<table>
<thead>
<tr>
<th>Year</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of new members</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total number of new members =

(b) From the graph, we can describe the trend for each of the following periods separately:
(i) from 2009 to 2012
(ii) from 2012 to 2015

Joe 12C 9, 10

7. The pie chart on the right shows the expenditures of Mr Chan last month.
(a) Find the angle of sector representing ‘Clothing’.
(b) Find $x$.
(c) Mr Chan claims that the expenditures on food and clothing are the same last month. Do you agree?
   Explain your answer.

(a) Angle of sector representing ‘Clothing’
   =

(b) Remember to write down the reason.

(c) ‘.’ The angles of sectors representing ‘Food’ and ‘Clothing’ (are / are not) the same.
   i.e. The expenditures on food and clothing (are / are not) the same.
   ‘.’ The claim is (agreed / disagreed).
8. The pie chart on the right shows the districts where all the employees of a company live.

(a) Find the percentage of employees who live on Hong Kong Island.

(b) It is given that 30 employees live on Hong Kong Island. How many employees are there in the company?

(a) The required percentage =

(b)

9. The broken line graphs on the right show the numbers of students of tutorial centres A and B in the first half year.

(a) Describe the trends of the numbers of students in tutorial centres A and B in the first half year.

(b) Which tutorial centre is more likely to have more students in July?
12 Introduction to Statistics

Level 1

1. The table below shows the means of travel to school by a class of students.

<table>
<thead>
<tr>
<th>Means of travel</th>
<th>Percentage of the whole</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bus</td>
<td>35%</td>
</tr>
<tr>
<td>Minibus</td>
<td>20%</td>
</tr>
<tr>
<td>Tram</td>
<td>15%</td>
</tr>
<tr>
<td>MTR</td>
<td>25%</td>
</tr>
<tr>
<td>On foot</td>
<td>5%</td>
</tr>
</tbody>
</table>

Find the angle of each sector in a pie chart presenting the above data.

2. The table below shows the occupations of participants in a birthday party.

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Number of participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doctor</td>
<td>10</td>
</tr>
<tr>
<td>Nurse</td>
<td>12</td>
</tr>
<tr>
<td>Lawyer</td>
<td>6</td>
</tr>
<tr>
<td>Teacher</td>
<td>8</td>
</tr>
<tr>
<td>Clerk</td>
<td>24</td>
</tr>
</tbody>
</table>

(a) Find the total number of participants in the party.

(b) Suppose a pie chart is constructed to show, in percentages, the distribution of the given data.

(i) Complete the following table.

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Percentage of the whole</th>
<th>Angle of sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doctor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nurse</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lawyer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clerk</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(ii) Construct the corresponding pie chart.

3. The table below shows different types of flowers sold by a shop yesterday.

<table>
<thead>
<tr>
<th>Type of flowers sold</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rose</td>
<td>65</td>
</tr>
<tr>
<td>Lily</td>
<td>46</td>
</tr>
<tr>
<td>Carnation</td>
<td>20</td>
</tr>
<tr>
<td>Tulip</td>
<td>27</td>
</tr>
<tr>
<td>Iris</td>
<td>22</td>
</tr>
</tbody>
</table>

Construct a pie chart to show the distribution of the above data and indicate each item as an angle of sector.
4. The pie chart on the right shows the time spent by Joe on different activities in the past 3 hours.
   (a) Find \( y \).
   (b) How long did Joe spend on studying?
   (c) Find the percentage of time spent by Joe on playing.

5. The pie chart on the right shows the nationalities of members of a football club.
   (a) Is the number of British members greater than that of Italian members? Explain your answer.
   (b) Find the percentage of Italian members of the football club.

6. A company conducts interviews to collect the opinions about the quality of a new product. The pie chart on the right shows the result obtained. If 54 interviewees give ‘Good’, find the total number of interviewees involved.

7. The table below shows the prices of an oil painting from 2009 to 2013.

<table>
<thead>
<tr>
<th>Year</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price ($)</td>
<td>3 400</td>
<td>2 700</td>
<td>3 200</td>
<td>2 800</td>
<td>2 500</td>
</tr>
</tbody>
</table>

Construct a broken line graph to present the above data.

8. The table below shows the average temperatures of a city last week.

<table>
<thead>
<tr>
<th>Day</th>
<th>Mon</th>
<th>Tue</th>
<th>Wed</th>
<th>Thu</th>
<th>Fri</th>
<th>Sat</th>
<th>Sun</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average temperature (°C)</td>
<td>28</td>
<td>35</td>
<td>30</td>
<td>25</td>
<td>22</td>
<td>23</td>
<td>20</td>
</tr>
</tbody>
</table>

Construct a broken line graph to present the above data.
9. The broken line graph below shows the profits of a restaurant from 2008 to 2013.

![Graph of Profits of a Restaurant from 2008 to 2013]

(a) Find the total profit of the restaurant from 2008 to 2013.
(b) Between which two successive years did the profit of the restaurant decrease the most?
(c) Describe the trend of the profits of the restaurant from 2008 to 2013.

10. The broken line graph below shows the numbers of complaints received by Consumer Council from April to August.

![Graph of Numbers of Complaints Received by Consumer Council from April to August]

(a) Describe the trend of the number of complaints received by Consumer Council from April to August.
(b) Predict the trend of the number of complaints received by Consumer Council in September.
11. The pie chart on the right shows the distribution of different types of fruits in a box. It is known that there are 48 lemons in the box.

(a) Find \( y \).

(b) Find the total number of fruits in the box.

(c) Find the number of apples in the box.

12. The pie chart on the right shows the distribution of items sold by a shop last year. It is known that the shop sold 8 100 smartphones and 2 070 scanners last year.

(a) Find \( t \).

(b) How many laptop computers were sold by the shop last year?

13. A social worker collected a set of data about the ages of smokers yesterday. The table below shows the result.

<table>
<thead>
<tr>
<th>Age group</th>
<th>Under 12</th>
<th>12 – 14</th>
<th>15 – 17</th>
<th>18 or above</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of smokers</td>
<td>6</td>
<td>8</td>
<td>24</td>
<td>42</td>
</tr>
</tbody>
</table>

(a) Construct a pie chart to show the distribution of the above data and indicate each age group as an angle of sector.

(b) Today, the social worker collects another set of data about the ages of smokers. He finds that he gets the same result as yesterday.

Later, he organizes all the data collected yesterday and today into a frequency distribution table, and constructs a pie chart accordingly.

Are the angles of sectors in his pie chart the same as those in (a)? Explain your answer.
14. The broken line graph below shows the numbers of members of the chess club from 2010 to 2014.

(a) Describe the trend of the numbers of members of the chess club from 2010 to 2014.

(b) By how many per cent did the numbers of members increase from 2011 to 2012?

15. The bar chart below shows the numbers of traffic accidents in a city from July to December in 2014.

(a) Use a broken line graph to present the data.

(b) It is known that the number of traffic accidents in November is 15% of that in the whole year. A student claims that more traffic accidents happened in the first half year of 2014 than in the second half year. Do you agree? Explain your answer.
16. The tables below show the expenditure of a family in each month.

<table>
<thead>
<tr>
<th>Month</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expenditure ($)</td>
<td>9 000</td>
<td>8 500</td>
<td>7 300</td>
<td>6 700</td>
<td>6 300</td>
<td>6 000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Month</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expenditure ($)</td>
<td>6 100</td>
<td>5 900</td>
<td>6 000</td>
<td>6 500</td>
<td>7 600</td>
<td>8 900</td>
</tr>
</tbody>
</table>

(a) Construct a broken line graph to present the above data.

(b) Describe the trend of the expenditure of the family in different seasons.

17. The broken line graphs below show the average temperatures of deserts A and B from Sunday to Friday.

(a) Describe the trends of the average temperatures of deserts A and B in these 6 days.

(b) Which desert is more likely to have a higher average temperature on Saturday?
Consolidation Exercise 12C (Answer)

1. bus: 126°, minibus: 72°, tram: 54°, MTR: 90°, on foot: 18°

2. (a) 60° (b) (i)

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Percentage of the whole</th>
<th>Angle of sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doctor</td>
<td>$\frac{2}{3}$%</td>
<td>60°</td>
</tr>
<tr>
<td>Nurse</td>
<td>20%</td>
<td>72°</td>
</tr>
<tr>
<td>Lawyer</td>
<td>10%</td>
<td>36°</td>
</tr>
<tr>
<td>Teacher</td>
<td>$\frac{1}{3}$%</td>
<td>48°</td>
</tr>
<tr>
<td>Clerk</td>
<td>40%</td>
<td>144°</td>
</tr>
</tbody>
</table>

4. (a) 150° (b) 1.25 hours (c) $8\frac{1}{3}$%

5. (a) no (b) 27.5%

6. 300

9. (a) $56\ 000\ 000$ (b) from 2008 to 2009 (c) The profit of the restaurant decreased gradually from 2008 to 2012. Then it remained unchanged from 2012 to 2013.

10. (a) The number of complaints received by Consumer Council increased gradually from April to August.

(b) The number of complaints received by Consumer Council will increase (or remain steady) in September.

11. (a) 110° (b) 540° (c) 165°

12. (a) 23 (b) 4320

13. (b) yes

14. (a) The number of members of the chess club increased gradually from 2010 to 2014.

(b) 20%

15. (b) no

16. (b) The expenditure of the family decreased gradually from spring to summer. The expenditure became steady in autumn. Finally, the expenditure increased gradually after autumn.

17. (a) The average temperature of desert A increased gradually from Sunday to Friday.
The average temperature of desert B increased gradually from Sunday to Wednesday. Then it decreased gradually from Wednesday to Friday.

(b) desert A
<table>
<thead>
<tr>
<th>Date</th>
<th>Task</th>
<th>Progress</th>
<th>Teacher's Signature</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

**FIB: Chapter 12D**

<table>
<thead>
<tr>
<th>Date</th>
<th>Task</th>
<th>Progress</th>
<th>Teacher's Signature</th>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Date</th>
<th>Task</th>
<th>Progress</th>
<th>Teacher's Signature</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Date</th>
<th>Task</th>
<th>Progress</th>
<th>Teacher's Signature</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Date</th>
<th>Task</th>
<th>Progress</th>
<th>Teacher's Signature</th>
</tr>
</thead>
<tbody>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Date</th>
<th>Task</th>
<th>Progress</th>
<th>Teacher's Signature</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Date</th>
<th>Task</th>
<th>Progress</th>
<th>Teacher's Signature</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Date</th>
<th>Task</th>
<th>Progress</th>
<th>Teacher's Signature</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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**Lesson Worksheet**
- Complete and Checked
- Problems encountered
- Skipped

**Book Example 9**
- Complete
- Problems encountered
- Skipped

**Book Example 10**
- Complete
- Problems encountered
- Skipped

**Book Example 11**
- Complete
- Problems encountered
- Skipped

**Book Example 12**
- Complete
- Problems encountered
- Skipped

**Book Example 13**
- Complete
- Problems encountered
- Skipped

**Consolidation Exercise**
- Complete and Checked
- Problems encountered
- Skipped

**Maths Corner Exercise 12D Level 1**
- Complete and Checked
- Problems encountered
- Skipped

**Maths Corner Exercise 12D Level 2**
- Complete and Checked
- Problems encountered
- Skipped

**Maths Corner Exercise 12D Level 3**
- Complete and Checked
- Problems encountered

---

118
<table>
<thead>
<tr>
<th></th>
<th>□ Skipped</th>
<th>□ Complete and Checked</th>
<th>Teacher’s Signature</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Maths Corner Exercise</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>12D Multiple Choice</strong></td>
<td>□ Problems encountered</td>
<td>□ Skipped</td>
<td></td>
</tr>
<tr>
<td><strong>E-Class Multiple Choice</strong></td>
<td>□ Problems encountered</td>
<td>□ Skipped</td>
<td></td>
</tr>
<tr>
<td><strong>Self-Test</strong></td>
<td>□ Complete and Checked</td>
<td>□ Problems encountered</td>
<td>□ Skipped</td>
</tr>
<tr>
<td></td>
<td>□ Problems encountered</td>
<td>□ Skipped</td>
<td></td>
</tr>
<tr>
<td></td>
<td>□ Complete and Checked</td>
<td>□ Problems encountered</td>
<td>□ Skipped</td>
</tr>
<tr>
<td></td>
<td>□ Problems encountered</td>
<td>□ Skipped</td>
<td></td>
</tr>
</tbody>
</table>

**Mark:**

_________
12.4C Stem-and-leaf Diagrams

1. Stem-and-leaf Diagrams

(a) A stem-and-leaf diagram can show the distribution of all the data while retaining the values of the whole set of data.

(b) In a stem-and-leaf diagram, the digits of each datum are separated into two parts, ‘stem’ and ‘leaf’, according to their place values.

e.g. The following data are represented by the stem-and-leaf diagram on the right, where the tens digit is taken as the ‘stem’ and the units digit is taken as the ‘leaf’.

<table>
<thead>
<tr>
<th>Stem</th>
<th>Leaf</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0 8</td>
</tr>
<tr>
<td>2</td>
<td>4 4 7</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
</tr>
</tbody>
</table>

10 18 24 24 27 35

1. Listed below are the ages of 8 people.

7 15 23 19 14 18 27 31

Follow the steps below to complete the stem-and-leaf diagram.

Step ①: Arrange the data in ascending order:
7 14 15 ___ ___ ___ ___ ___

Step ②: Choose suitable place values for the ‘stem’ and the ‘leaf’ by considering the range of the data.

Take tens digit as the ‘stem’ and _____ digit as the ‘leaf’.

Step ③: In the table with two columns below,

(i) on the ‘stem’ column, list the values in ascending order (from top to bottom);
(ii) on the ‘leaf’ column, list the values corresponding to the ‘stem’ in ascending order (from left to right).

Step ④: Give a title to the stem-and-leaf diagram.

1. For the datum 7, take 0 as the ‘stem’ and 7 as the ‘leaf’.

Step ⑤

<table>
<thead>
<tr>
<th>Stem (10)</th>
<th>Leaf (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>1</td>
<td>4 5</td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

For the datum 7, take 0 as the ‘stem’ and 7 as the ‘leaf’.
Example 1
Listed below are the weights (in kg) of 10 students.

| 38 | 62 | 36 | 40 | 47 |
| 36 | 61 | 34 | 48 | 39 |

Construct a stem-and-leaf diagram to present the above data.

**Sol** [Arrange the data (in kg) in ascending order:

| 34 | 36 | 36 | 38 | 39 |
| 40 | 47 | 48 | 61 | 62 |

**Weights of 10 students**

<table>
<thead>
<tr>
<th>Stem (10 kg)</th>
<th>Leaf (1 kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>4 6 6 8 9</td>
</tr>
<tr>
<td>4</td>
<td>0 7 8</td>
</tr>
<tr>
<td>5</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>1 2</td>
</tr>
</tbody>
</table>

Instant Drill 1
Listed below are the prices (in $) of 8 kinds of food.

| 21 | 13 | 44 | 25 |
| 27 | 46 | 18 | 59 |

Construct a stem-and-leaf diagram to present the above data.

**Sol** [Arrange the data (in $) in ascending order:

| 13 | 18 | 21 | ___ | ___ | ___ | ___ |

<table>
<thead>
<tr>
<th>Stem ($__)</th>
<th>Leaf ($__)</th>
</tr>
</thead>
</table>

2. Listed below are the heights (in cm) of a group of children.

| 85 | 83 | 92 | 104 | 81 | 89 | 92 | 98 |
| 90 | 80 | 95 | 103 | 97 | 93 | 84 | 106 |

Construct a stem-and-leaf diagram to present the above data.

For the datum 103 cm, take both the tens and the hundreds digits as the ‘stem’, i.e. write ‘10’ in the ‘stem’ column and ‘3’ in the ‘leaf’ column.
Example 2
The stem-and-leaf diagram below shows the speeds (in km/h) of 15 vehicles passing through a road.

<table>
<thead>
<tr>
<th>Speeds of 15 vehicles</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stem (10 km/h)</strong></td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>6</td>
</tr>
</tbody>
</table>

(a) Find the lowest speed among the vehicles.
(b) Find the highest speed among the vehicles.
(c) How many vehicles travelled at speeds higher than 62 km/h?

**Sol**
(a) The lowest speed is 49 km/h.
(b) The highest speed is 68 km/h.
(c) From the diagram, 4 vehicles travelled at speeds higher than 62 km/h.

Instant Drill 2
The stem-and-leaf diagram below shows the scores of 12 participants in a competition.

<table>
<thead>
<tr>
<th>Scores of 12 participants in a competition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stem (10)</strong></td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>5</td>
</tr>
</tbody>
</table>

(a) Find the lowest score among the 12 participants.
(b) Find the highest score among the 12 participants.
(c) How many participants scored less than 30?

**Sol**
(a) The lowest score is ________.
(b) The highest score is ________.
(c) From the diagram, ________ participants scored less than 30.

3. The stem-and-leaf diagram on the right shows the prices (in $) of 12 pairs of sports shoes.

(a) Among these sports shoes, find the price of the most expensive one.
(b) Find the number of pairs of sports shoes with prices less than $140.
(c) Find the number of pairs of sports shoes with prices greater than $300.

<table>
<thead>
<tr>
<th>Prices of 12 pairs of sports shoes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stem ($100)</strong></td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
</tbody>
</table>

\[ Ex 12D \]
II. Back-to-back Stem-and-leaf Diagrams

A back-to-back stem-and-leaf diagram is used to compare the distributions of two sets of data of the same kind.

e.g. The back-to-back stem-and-leaf diagram on the right shows the scores of teams A and B in a competition.

<table>
<thead>
<tr>
<th>Scores of teams A and B in a competition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Team A</td>
</tr>
<tr>
<td>Leaf (1)</td>
</tr>
<tr>
<td>4 3 2 0</td>
</tr>
<tr>
<td>8 5</td>
</tr>
<tr>
<td>3</td>
</tr>
</tbody>
</table>

Example 3
Listed below are the scores of James and Sandy in a game of 6 rounds.
James: 70 56 67 74 58 62
Sandy: 68 73 78 62 70 75

Construct a back-to-back stem-and-leaf diagram to present the above two sets of data.

Sol [Arrange the two sets of data in ascending order respectively.
James: 56 58 62 67 70 74
Sandy: 62 68 70 73 75 78]

Instant Drill 3
Listed below are the time (in s) spent by 8 children to complete two games.
Game 1:
83 64 57 74 63 82 60 79
Game 2:
68 49 67 50 42 58 63 48

Construct a back-to-back stem-and-leaf diagram to present the above two sets of data.

Sol [Arrange the two sets of data in ascending order respectively.
Game 1:

Game 2:

Scores of James and Sandy in a game of 6 rounds

<table>
<thead>
<tr>
<th>James</th>
<th>Sandy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leaf (1)</td>
<td>Stem (10)</td>
</tr>
<tr>
<td>8 6</td>
<td>5</td>
</tr>
<tr>
<td>7 2</td>
<td>6</td>
</tr>
<tr>
<td>4 0</td>
<td>7</td>
</tr>
</tbody>
</table>

Arrange the digits in ascending order from right to left.
4. Listed below are the ages of the players in basketball teams A and B.

Team A: 15 16 18 21 17 22 19 22 25 18
Team B: 17 20 23 25 26 28 18 21 24 30

(a) Construct a back-to-back stem-and-leaf diagram to present the above two sets of data.

(b) For the two teams of players, which of them are younger in general?

(a)

(b) From the diagram, the ages of most of the players in team A are lower than __________, and the ages of most of the players in team B are higher than __________. Therefore, the players in team (A/B) are younger than those in team (A/B) in general.

12.4D Scatter Diagrams

(a) A scatter diagram is used to show the relationship between two sets of data.

(b) A pair of corresponding values from the two sets of data forms an ordered pair. All the ordered pairs are then represented by scattered points in a rectangular coordinate plane.

5. The following table shows the weights of 6 boys of different heights.

<table>
<thead>
<tr>
<th>Height (m)</th>
<th>1.5</th>
<th>1.6</th>
<th>1.7</th>
<th>1.6</th>
<th>1.65</th>
<th>1.7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (kg)</td>
<td>48</td>
<td>50</td>
<td>54</td>
<td>60</td>
<td>62</td>
<td>68</td>
</tr>
</tbody>
</table>

Follow the steps below to complete the scatter diagram.

Step ①: Draw the scales on the horizontal and vertical axes. Then, label the two axes. Each axis corresponds to the values of a set of data.

Step ②: Form order pairs by the values from the two sets of data, and indicate them by ‘X’s.

E.g. ‘Height 1.5 m’ and ‘weight 48 kg’ form an ordered pair (1.5, 48).

Step ③: Give a title to the scatter diagram.
Example 4
The table below shows the dictation marks of 6 students and their weekly study time.

<table>
<thead>
<tr>
<th>Study time (hours)</th>
<th>10</th>
<th>12</th>
<th>6</th>
<th>8</th>
<th>4</th>
<th>14</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marks</td>
<td>76</td>
<td>80</td>
<td>52</td>
<td>64</td>
<td>58</td>
<td>78</td>
</tr>
</tbody>
</table>

Construct a scatter diagram to present the above data.

Sol

The table below shows the sales volumes of chicken wings with different unit prices.

<table>
<thead>
<tr>
<th>Unit price ($)</th>
<th>10</th>
<th>12</th>
<th>14</th>
<th>16</th>
<th>18</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales volume</td>
<td>116</td>
<td>116</td>
<td>80</td>
<td>52</td>
<td>40</td>
<td>40</td>
</tr>
</tbody>
</table>

Construct a scatter diagram to present the above data.

Sol

In general, scatter diagrams may indicate the following 3 cases.

(a) Positive relationship
When the value of $x$ increases, the value of $y$ increases.

(b) Negative relationship
When the value of $x$ increases, the value of $y$ decreases.

(c) No direct relationship
The values of $x$ and $y$ do NOT have a clear relationship.

6. In each of the following, describe the relationship between the two sets of data.

(a) Scores of 11 students in sections $A$ and $B$ of a test

The higher the score in section $A$, the __________ the score in section $B$.

(b) Heart rates of 12 girls of different heights

(c) Web surfing time of 14 people of different ages per day

The values of $x$ and $y$ do NOT have a clear relationship.
7. A medical organization conducts a survey to find out the relationship between the time spent on doing exercise per week of a group of 10-year-old boys and their weights. The scatter diagram on the right shows the result.

(a) Wally is one of the interviewees. It is given that his weight is 41 kg. Find the time spent by him on doing exercise per week.

(b) From the scatter diagram, describe the relationship between the time spent on doing exercise per week of the group of boys and their weights.

8. Listed below are the scores of 16 S1 students in Chinese Language quizzes before and after attending a tutorial course.

Before the course: 24 10 8 16 18 4 22 27 14 5 9 17 0 21 6 12
After the course: 20 26 31 25 4 19 30 28 8 27 13 22 16 37 33 30

(a) Construct a back-to-back stem-and-leaf diagram to present the above two sets of data.

(b) Is the course useful in improving the performances of the students? Explain your answer.
9. Listed below are the prices (in $) of 16 pairs of jeans.

<p>| | | | | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>198</td>
<td>220</td>
<td>370</td>
<td>482</td>
<td>429</td>
<td>145</td>
<td>546</td>
<td>449</td>
<td>501</td>
<td>236</td>
</tr>
</tbody>
</table>

Construct a stem-and-leaf diagram to present the above data.

10. The table below shows the time spent on watching TV by a group of people of different ages per day.

<table>
<thead>
<tr>
<th>Age</th>
<th>15</th>
<th>18</th>
<th>20</th>
<th>25</th>
<th>32</th>
<th>36</th>
<th>40</th>
<th>48</th>
<th>52</th>
<th>60</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time (hours)</td>
<td>1.4</td>
<td>2.2</td>
<td>3.6</td>
<td>2.8</td>
<td>2.0</td>
<td>3.5</td>
<td>4.0</td>
<td>1.8</td>
<td>3.2</td>
<td>4.5</td>
</tr>
</tbody>
</table>

(a) Construct a scatter diagram to present the above data.

(b) From the scatter diagram in (a), describe the relationship between the ages of the group of people and their time spent on watching TV per day.

(a)
12 Introduction to Statistics

Level 1

1. Listed below are the numbers of words of 18 messages recorded by a secretary.

<p>| | | | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>32</td>
<td>36</td>
<td>24</td>
<td>44</td>
<td>45</td>
<td>31</td>
<td>20</td>
<td>42</td>
<td>38</td>
</tr>
<tr>
<td>35</td>
<td>45</td>
<td>49</td>
<td>27</td>
<td>32</td>
<td>37</td>
<td>48</td>
<td>38</td>
<td>26</td>
</tr>
</tbody>
</table>

Construct a stem-and-leaf diagram to present the above data.

2. Listed below are the blood pressures (in mmHg) of a group of people.

<p>| | | | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>108</td>
<td>116</td>
<td>113</td>
<td>124</td>
<td>96</td>
<td>110</td>
<td>115</td>
<td>133</td>
<td>127</td>
</tr>
<tr>
<td>99</td>
<td>102</td>
<td>118</td>
<td>121</td>
<td>125</td>
<td>105</td>
<td>130</td>
<td>115</td>
<td>137</td>
</tr>
</tbody>
</table>

Construct a stem-and-leaf diagram to present the above data.

3. The stem-and-leaf diagram below shows the prices of 15 toys in a shop.

<table>
<thead>
<tr>
<th>Prices of 15 toys in a shop</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stem ($100)</strong></td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>6</td>
</tr>
</tbody>
</table>

(a) Write down the price of the most expensive toy among them.

(b) How many of them are with prices greater than $400?

(c) Jeff has spent less than $300 to buy one of the 15 toys. What is the price of that toy?

4. A teacher divides some students into two groups and then records the time (in minutes) spent by each student to finish a test. The following are the results.

<table>
<thead>
<tr>
<th>Group A</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>132</td>
<td>125</td>
<td>128</td>
<td>136</td>
<td></td>
</tr>
<tr>
<td>140</td>
<td>145</td>
<td>148</td>
<td>120</td>
<td></td>
</tr>
<tr>
<td>130</td>
<td>135</td>
<td>144</td>
<td>138</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group B</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>120</td>
<td>124</td>
<td>135</td>
<td>128</td>
<td></td>
</tr>
<tr>
<td>145</td>
<td>130</td>
<td>147</td>
<td>126</td>
<td></td>
</tr>
<tr>
<td>130</td>
<td>125</td>
<td>136</td>
<td>140</td>
<td></td>
</tr>
</tbody>
</table>

Construct a back-to-back stem-and-leaf diagram to present the above two sets of data.
5. The back-to-back stem-and-leaf diagram below shows the heights of plants in two gardens A and B.

**Heights of plants in gardens A and B**

<table>
<thead>
<tr>
<th>Garden A</th>
<th>Garden B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leaf (1 cm)</td>
<td>Stem (10 cm)</td>
</tr>
<tr>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>5 2</td>
<td>11</td>
</tr>
<tr>
<td>7 6 4</td>
<td>12</td>
</tr>
<tr>
<td>9 6 2 2 1 0</td>
<td>13</td>
</tr>
<tr>
<td>8 8 3</td>
<td>14</td>
</tr>
</tbody>
</table>

Are the plants in garden A taller than the plants in garden B in general? Explain your answer.

6. The table below shows the ages of some students and the amounts of their monthly pocket money.

<table>
<thead>
<tr>
<th>Age</th>
<th>7</th>
<th>10</th>
<th>9</th>
<th>11</th>
<th>11</th>
<th>8</th>
<th>12</th>
<th>7</th>
<th>9</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monthly pocket money ($)</td>
<td>177</td>
<td>180</td>
<td>175</td>
<td>172</td>
<td>178</td>
<td>170</td>
<td>179</td>
<td>180</td>
<td>181</td>
<td>174</td>
</tr>
</tbody>
</table>

Construct a scatter diagram to present the above data.

7. The table below shows the average lifespan of a certain type of plants in a greenhouse and the corresponding temperatures.

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>34</th>
<th>32</th>
<th>31</th>
<th>31</th>
<th>37</th>
<th>35</th>
<th>33</th>
<th>36</th>
<th>34</th>
<th>36</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average lifespan (months)</td>
<td>13</td>
<td>8</td>
<td>10</td>
<td>9</td>
<td>18</td>
<td>15</td>
<td>11</td>
<td>18</td>
<td>12</td>
<td>17</td>
</tr>
</tbody>
</table>

Construct a scatter diagram to present the above data.

8. A survey is conducted to investigate the relationship between the time spent by some people on doing exercise each month and their body mass indices. The scatter diagram on the right shows the results.

From the scatter diagram, describe the relationship between the time spent by the people on doing exercise each month and their body mass indices.
Listed below are the heights (in m) of 20 mountains in a country.

\[ \begin{align*}
628 & \quad 535 & \quad 488 & \quad 706 & \quad 747 & \quad 653 & \quad 672 & \quad 440 & \quad 834 & \quad 644 \\
576 & \quad 732 & \quad 633 & \quad 658 & \quad 869 & \quad 507 & \quad 694 & \quad 708 & \quad 788 & \quad 616
\end{align*} \]

Construct a stem-and-leaf diagram to present the above data.

Listed below are the weights (in tons) of solid waste disposed in a city during the past 18 years.

\[ \begin{align*}
6 \quad 520 & \quad 6 \quad 380 & \quad 5 \quad 450 & \quad 7 \quad 200 & \quad 4 \quad 790 & \quad 6 \quad 840 \\
5 \quad 160 & \quad 8 \quad 630 & \quad 6 \quad 670 & \quad 4 \quad 350 & \quad 7 \quad 800 & \quad 5 \quad 610 \\
3 \quad 850 & \quad 6 \quad 770 & \quad 6 \quad 120 & \quad 7 \quad 480 & \quad 6 \quad 550 & \quad 5 \quad 900
\end{align*} \]

Construct a stem-and-leaf diagram to present the above data.

The stem-and-leaf diagram below shows the costs of 25 items produced by a factory.

<table>
<thead>
<tr>
<th>Stem ($10$)</th>
<th>Leaf ($1$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>2 8</td>
</tr>
<tr>
<td>8</td>
<td>3 3 5 6</td>
</tr>
<tr>
<td>9</td>
<td>x 1 2 2 4 7 8</td>
</tr>
<tr>
<td>10</td>
<td>5 6 6 8 9</td>
</tr>
<tr>
<td>11</td>
<td>0 3 5 6</td>
</tr>
<tr>
<td>12</td>
<td>2 8 8</td>
</tr>
</tbody>
</table>

(a) Write down all the possible values of $x$.

(b) The factory adopts a new policy such that the cost of each of the 25 items is reduced by $2$.

Under the new policy, find

(i) the number of items with costs less than $90$,

(ii) the percentage of items with costs greater than $110$.

The tables below show the examination results of 18 students before and after joining a tutorial course.

<table>
<thead>
<tr>
<th>Before joining the tutorial course</th>
<th>After joining the tutorial course</th>
</tr>
</thead>
<tbody>
<tr>
<td>43 45 51 34 47 46</td>
<td>46 53 55 58 60 62</td>
</tr>
<tr>
<td>50 52 35 47 42 48</td>
<td>54 57 44 46 61 55</td>
</tr>
<tr>
<td>37 40 41 51 49 43</td>
<td>58 64 47 61 56 59</td>
</tr>
</tbody>
</table>

(a) Construct a back-to-back stem-and-leaf diagram to present the above two sets of data.

(b) Is the tutorial course useful in improving the performances of the students? Explain your answer.

(c) If the passing mark is 40, find the percentage increase in the passing rate of the students.
13. The tables below show the 50 m freestyle swimming records of 20 boys and their average practising time per week.

<table>
<thead>
<tr>
<th>Swimming record (s)</th>
<th>33</th>
<th>30</th>
<th>33</th>
<th>26</th>
<th>27</th>
<th>41</th>
<th>33</th>
<th>28</th>
<th>27</th>
<th>39</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average practising time per week (min)</td>
<td>80</td>
<td>125</td>
<td>105</td>
<td>230</td>
<td>215</td>
<td>65</td>
<td>130</td>
<td>175</td>
<td>200</td>
<td>95</td>
</tr>
<tr>
<td>Swimming record (s)</td>
<td>24</td>
<td>29</td>
<td>29</td>
<td>39</td>
<td>32</td>
<td>30</td>
<td>25</td>
<td>28</td>
<td>26</td>
<td>26</td>
</tr>
<tr>
<td>Average practising time per week (min)</td>
<td>280</td>
<td>165</td>
<td>150</td>
<td>90</td>
<td>115</td>
<td>145</td>
<td>265</td>
<td>170</td>
<td>250</td>
<td>245</td>
</tr>
</tbody>
</table>

(a) Construct a scatter diagram to present the above data.
(b) According to the scatter diagram in (a), describe the relationship between the 50 m freestyle swimming records of the boys and their average practising time per week.

14. The table below shows the profits of 16 companies and the average monthly salaries of their staff in 2014.

<table>
<thead>
<tr>
<th>Company</th>
<th>Profit (million dollars)</th>
<th>Average monthly salary (thousand dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANG</td>
<td>215</td>
<td>16</td>
</tr>
<tr>
<td>BOO Research</td>
<td>275</td>
<td>18</td>
</tr>
<tr>
<td>Carrefive</td>
<td>325</td>
<td>21</td>
</tr>
<tr>
<td>D&amp;E Video</td>
<td>385</td>
<td>23</td>
</tr>
<tr>
<td>Fogg, Inc.</td>
<td>445</td>
<td>24</td>
</tr>
<tr>
<td>Gogoz.com</td>
<td>220</td>
<td>17</td>
</tr>
<tr>
<td>H. L. Systems</td>
<td>430</td>
<td>25</td>
</tr>
<tr>
<td>IER Motors</td>
<td>340</td>
<td>22</td>
</tr>
<tr>
<td>JJ Limited</td>
<td>400</td>
<td>23</td>
</tr>
<tr>
<td>K7 Networks</td>
<td>415</td>
<td>24</td>
</tr>
<tr>
<td>PA Sports</td>
<td>235</td>
<td>17</td>
</tr>
<tr>
<td>Phoenix Airways</td>
<td>405</td>
<td>24</td>
</tr>
<tr>
<td>Popop Company</td>
<td>365</td>
<td>23</td>
</tr>
<tr>
<td>SiSi Pizza</td>
<td>255</td>
<td>19</td>
</tr>
<tr>
<td>uBay</td>
<td>280</td>
<td>19</td>
</tr>
<tr>
<td>YI Computer</td>
<td>300</td>
<td>21</td>
</tr>
</tbody>
</table>

(a) Construct a scatter diagram to present the above data.
(b) According to the scatter diagram in (a), describe the relationship between the profits of the 16 companies and the average monthly salaries of their staff in 2014.
Consolidation Exercise 12D

3. (a) $628  (b) 6  (c) $220
5. yes
8. When the people spend less time on doing exercise each month, their body mass indices are higher.
11. (a) 0, 1
   (b) (i) 8  (ii) 24%
12. (b) yes  (c) 20%

13. (b) The longer the average practising time per week, the better the 50 m freestyle swimming record.
14. (b) The higher the profit of a company, the higher the average monthly salary of the staff.
<table>
<thead>
<tr>
<th>Date</th>
<th>Task</th>
<th>Progress</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lesson Worksheet</td>
<td>Complete and Checked</td>
<td>(Full Solution)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Problems encountered</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Skipped</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Book Example 14</td>
<td>Complete</td>
<td>(Video Teaching)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Problems encountered</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Skipped</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Book Example 15</td>
<td>Complete</td>
<td>(Video Teaching)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Problems encountered</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Skipped</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Book Example 16</td>
<td>Complete</td>
<td>(Video Teaching)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Problems encountered</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Skipped</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Book Example 17</td>
<td>Complete</td>
<td>(Video Teaching)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Problems encountered</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Skipped</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Consolidation Exercise</td>
<td>Complete and Checked</td>
<td>(Full Solution)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Problems encountered</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Skipped</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Maths Corner Exercise 12E Level 1</td>
<td>Complete and Checked</td>
<td>Teacher’s Signature</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Problems encountered</td>
<td>(         )</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Skipped</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Maths Corner Exercise 12E Level 2</td>
<td>Complete and Checked</td>
<td>Teacher’s Signature</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Problems encountered</td>
<td>(         )</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Skipped</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Maths Corner Exercise 12E Level 3</td>
<td>Complete and Checked</td>
<td>Teacher’s Signature</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Problems encountered</td>
<td>(         )</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Skipped</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Maths Corner Exercise 12E Multiple Choice</td>
<td>Complete and Checked</td>
<td>Teacher’s Signature</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Problems encountered</td>
<td>(         )</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Skipped</td>
<td></td>
</tr>
<tr>
<td></td>
<td>E-Class Multiple Choice Self-Test</td>
<td>Complete and Checked</td>
<td>Mark:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Problems encountered</td>
<td></td>
</tr>
</tbody>
</table>
12.5A Choosing Suitable Statistical Diagrams

(a) Statistical diagrams learnt before:
- Bar chart
- Pie chart
- Broken line graph
- Stem-and-leaf diagram
- Back-to-back stem-and-leaf diagram
- Scatter diagram

(b) Consider what information we want to obtain from the data and then choose a suitable statistical diagram to present the data.

Example 1
A hospital records the genders, lengths and weights of all newborn babies. Choose the most suitable statistical diagram to present the data for each of the following.

(a) To show the number of newborn babies of each gender as a percentage of the whole.
(b) To show the relationship between the lengths and weights of the newborn babies.

Sol (a) A pie chart is the most suitable statistical diagram to present the data.
(b) A scatter diagram is the most suitable statistical diagram to present the data.

Instant Drill 1
A boutique records the monthly sales volumes of the sportswear of different sizes. Choose the most suitable statistical diagram to present the data for each of the following.

(a) To show clearly the sales volumes of the sportswear of each size in January.
(b) To show the changes of the monthly sales volume of sportswear of large size.

Sol (a) ________________ is the most suitable statistical diagram to present the data.
(b) ________________ is the most suitable statistical diagram to present the data.

1. Choose the most suitable statistical diagram to present the data for each of the following.

(a) To compare the marks scored by S1A and S1B in a mathematics examination, and to show clearly the marks scored by each student.
(b) To show the number of each type of shoes as a percentage to the total number of shoes of Miss Lee.
(c) To show the relationship between the costs and the prices of 10 washing machines.
(d) To show the distribution of the blood pressures of 12 adults, and to show clearly the blood pressure of each adult.

Ex 12E 1–3
**Example 2**

The broken line graph below shows the profits of a company from 2012 to 2014.

**Profits of a company from 2012 to 2014**

(l) How does the given graph impress readers?

(b) By how many per cent is the profit in 2014 more than that in 2012?

(c) Is the broken line graph misleading? Explain your answer.

**Solution**

(a) The graph gives readers an impression that the profits in 2014 is much more than that in 2012.

(b) Profit in 2012 = $100\,000

Profit in 2014 = $125\,000

The required percentage

\[
\frac{125\,000 - 100\,000}{100\,000} \times 100\% = 25\%
\]

(c) From (b), the profit in 2014 is only 25% more than that in 2012.

\[\therefore \text{The graph is misleading.}\]

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**Instant Drill 2**

The broken line graph shows the unemployed populations in a city in the past 3 months.

**Unemployed populations in a city in the past 3 months**

(a) How does the given graph impress readers?

(b) By how many per cent is the unemployed population in March less than that in January? (Give the answer correct to the nearest 0.1%.)

(c) Is the broken line graph misleading? Explain your answer.

**Solution**

(a) The graph gives readers an impression that

(b) Unemployed population in January =

Unemployed population in March =

The required percentage =

(c) From (b), ____________

\[\therefore \text{The graph (is / is not) misleading.}\]
2. The bar chart on the right shows the marks scored by Maggie in the English Language and Mathematics examinations.

(a) How does the given bar chart impress readers?
(b) By how many per cent are the marks in English Language higher than that in Mathematics?
(c) Is the given bar chart misleading? Explain your answer.

3. Mr Tsui constructs the following statistical diagram to show the sales volumes of light bulbs of two brands, Moody and Winner.

Sales volumes of light bulbs of Moody and Winner

Does the diagram give a fair comparison of the sales volumes of light bulbs of the two brands? Explain your answer.

4. The pie charts below show the distributions of expenditures of Mr Cheung and Mr Wong over the whole year.

Expenditure of Mr Cheung

Expenditure of Mr Wong

Based on the two charts, Mr Cheung concludes that his expenditure on rent is less than that of Mr Wong. Do you agree? Explain your answer.
5. The pie charts below show the types of flowers in gardens A and B.

**Types of flowers in garden A**

- Jasmine: 50%
- Rose: 20%
- Lily: 30%

**Types of flowers in garden B**

- Rose: x%
- Jasmine: 60%
- Lily: 20%

(a) Does garden B have the same number of roses and lilies? Explain your answer.

(b) Based on the two charts, Ada concludes that the numbers of roses in gardens A and B are the same. Do you agree? Explain your answer.

6. Mandy uses the graph on the right and concludes that her results in the past 10 dictations improved gradually. Do you agree? Explain your answer.
12 Introduction to Statistics

Level 1

1. Choose the most suitable statistical diagram to present the data for each of the following.
   (a) To show clearly the numbers of animals in different zoos.
   (b) To show the relationship between the monthly salaries and the working hours of the staff in a company.
   (c) To compare the test marks obtained by S1A and S1B students.
   (d) To show the variation of the price of an antique in each month last year.

2. The table below shows the number of medals got by each S1 class in the school swimming gala.

<table>
<thead>
<tr>
<th>Class</th>
<th>1A</th>
<th>1B</th>
<th>1C</th>
<th>1D</th>
<th>1E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of medals</td>
<td>6</td>
<td>15</td>
<td>12</td>
<td>7</td>
<td>10</td>
</tr>
</tbody>
</table>

Choose the most suitable statistical diagram to present the data for each of the following.
   (a) To show the number of medals got by each class as a percentage of the total number of medals.
   (b) To show the difference between the numbers of medals got by the five S1 classes.

3. Listed below are the numbers of floors in 12 buildings.

   17 15 24 8 12 14 9 25 9 18 21 16

   Carol wants to present the above data by a statistical diagram. Which diagram should she use such that she can read the exact number of floors in each building from the diagram?

4. The broken line graph below shows the numbers of members of a fans club from January to June.

   (a) How does the given broken line graph impress readers?
   (b) By how many per cent is the number of members in June greater than that in January? (Give
the answer correct to the nearest 0.1%.)

(c) Is the given broken line graph misleading? Explain your answer.

5. The statistical diagram below shows the annual production of a toy factory from 2012 to 2014.

![Annual production of a toy factory from 2012 to 2014](image)

Does the diagram give a fair comparison of the annual production? Explain your answer.

6. An organization uses the following pie charts to compare the nutrition information of two new brands of soft drinks.

![Nutrition information of Dark Bull Soft Drink](image)

![Nutrition information of Red Cat Soft Drink](image)

The organization claims that the two new brands of soft drinks contain the same amount of sugar. Do you agree? Explain your answer.
7. The tables below show the examination results of 16 candidates and their corresponding candidate numbers.

<table>
<thead>
<tr>
<th>Candidate number</th>
<th>101</th>
<th>102</th>
<th>103</th>
<th>104</th>
<th>105</th>
<th>106</th>
<th>107</th>
<th>108</th>
</tr>
</thead>
<tbody>
<tr>
<td>Result</td>
<td>81</td>
<td>72</td>
<td>64</td>
<td>53</td>
<td>74</td>
<td>62</td>
<td>56</td>
<td>49</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Candidate number</th>
<th>109</th>
<th>110</th>
<th>111</th>
<th>112</th>
<th>113</th>
<th>114</th>
<th>115</th>
<th>116</th>
</tr>
</thead>
<tbody>
<tr>
<td>Result</td>
<td>45</td>
<td>66</td>
<td>68</td>
<td>58</td>
<td>77</td>
<td>82</td>
<td>41</td>
<td>60</td>
</tr>
</tbody>
</table>

(a) Is it suitable to use a scatter diagram or a broken line graph to present the above data? Explain your answer.

(b) Construct a suitable statistical diagram to present the above data.

8. The statistical diagram below shows the numbers of newborn babies in a town in 2008 and 2014.

(a) How many times the area of the figure representing the number of newborn babies in 2008 is that in 2014?

(b) How many times the number of newborn babies in 2008 is that in 2014?

(c) Is the given statistical diagram misleading? Explain your answer.
9. The pie charts below show the monthly expenditures of Peter and Joyce.

(a) Joyce claims that she spends more on food than on clothing each month. Do you agree? Explain your answer.

(b) Based on the two charts, is the rent paid by Peter less than the rent paid by Joyce? Explain your answer.

10. The manager of a company uses the broken line graph below to declare:
‘We improve our services a lot. The number of complaints from customers keeps on decreasing from April to December. The decrease is more significant since August.’

(a) Point out three parts in the given graph that are misleading.

(b) Construct another broken line graph to express numbers of complaints received by the company in a more correct way (use dotted line(s) to represent those unknown or uncertain data).
11. The table below shows the sales volumes of EHQ computers from January to August.

<table>
<thead>
<tr>
<th>Month</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales volume (thousand)</td>
<td>3</td>
<td>5</td>
<td>2</td>
<td>7</td>
<td>1</td>
<td>8</td>
<td>9</td>
<td>2</td>
</tr>
</tbody>
</table>

The manufacturer of EHQ computers shows the following broken line graph to the investors. He claims that the sales volume of EHQ computers keeps on increasing, which guarantees a good profit each month.

(a) How does the broken line graph impress readers?
(b) Point out two parts in the broken line graph that are misleading.
(c) Using all the data provided in the table, construct another broken line graph to show the sales volumes of EHQ computers from January to August. Hence, describe the trend of the sales volume of EHQ computers from January to August.
Consolidation Exercise 12E (Answer)

1. (a) bar chart
   (b) scatter diagram
   (c) back-to-back stem-and-leaf diagram
   (d) broken line graph

2. (a) pie chart
   (b) bar chart

3. stem-and-leaf diagram

4. (a) The broken line graph gives readers an impression that the number of members increases significantly from January to June.
   (b) 6.3%
   (c) yes

5. No. The diagram misleads the readers by using areas of the figures to compare the annual production.

6. No. The volume of each brand of soft drink is not shown.

7. (a) No.
   Scatter diagram: there are no relationships between ‘candidate number’ and ‘examination result’;
   broken line graph: the given data are examination results but there is no change in the data.

8. (a) 9 times (b) 3 times (c) yes

9. (a) yes (b) no

10. (a) a large portion of the vertical axis is deleted;
    uneven scale in the horizontal axis;
    the month October in the horizontal axis is missing

11. (a) The broken line graph gives readers an impression that the sales volume of EHQ computers always goes up and never goes down.
    (b) uneven scale in the horizontal axis;
    the sales volumes in March, May and August are missing
    (c) The sales volume fluctuated between 1 000 and 9 000.