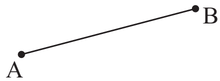
Chapter 2

ANGLES, LINES, AND PARALLELISM

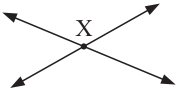
EXERCISE 2A

1 **a** A line segment connects two points.
In the diagram, the line segment [AB] connects points A and B.

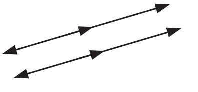


b A ray starts at a point, passes through another point, then continues on forever in that direction.
The diagram shows ray [AB).

c A point of intersection is where *two* lines meet or intersect.
In the diagram, the two lines have X as the point of intersection.

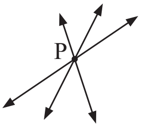


d Parallel lines are always a fixed distance apart and never meet.



e Collinear points lie on the same straight line.
In the diagram, points A, B, C, and D are collinear.

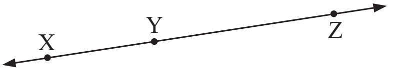
f We say that three or more lines are concurrent if they meet or intersect at the same point.
In the diagram, the lines are concurrent at P.



2 **a**

This line could be named (AB) or (BA).

b



This line could be named
(XY), (XZ), (YX), (YZ), (ZX), or (ZY).

3 **a** Triangle PQR shown has sides [PQ], [QR], and [PR].

b The sides that intersect at P are the ones that start or end at P.
These are [PQ] and [PR].

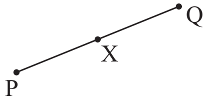
4 **a** Line 2 and line 3 intersect at B.

b Line 1 and line 3 intersect at C.

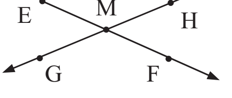
c C lies on (AB), and also lies on [DE].
$\therefore$ (AB) and [DE] intersect at C.

d [AC] and [DF] intersect at B.

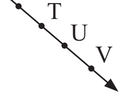
5 **a**



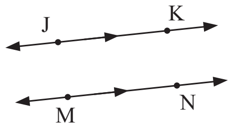
b



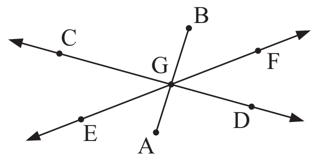
c



d



e



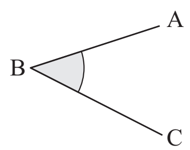
6 **a** Points C and E lie on line (AB).
So, the line could also be named in the following ways (pick any three):
(AC), (AE), (BA), (BC), (BE), (CA), (CB), (CE), (EA), (EB), (EC).

b The three lines (AD), (BD), and (CD) go through point D.

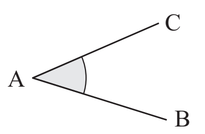
c **i** Lines (EF) and (AD) intersect at F.
ii Points A, D, and F are collinear (they lie on the same straight line).
iii Lines (CD) and (EG) are parallel.

EXERCISE 2B

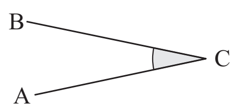
1 **a** **C**



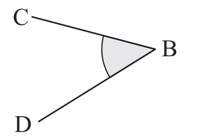
b **A**



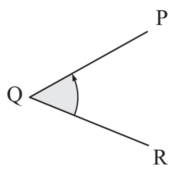
c **D**



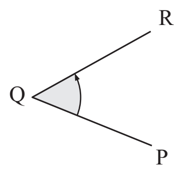
d **B**



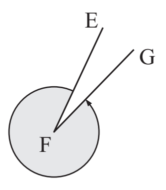
2 **a**



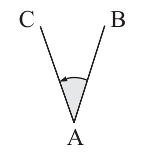
b



c



d



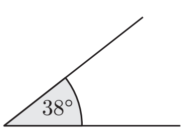
3 **a** $S\widehat{T}U = 25°$

b $W\widehat{T}U = W\widehat{T}V + V\widehat{T}U$
$= 27° + 32°$
$= 59°$

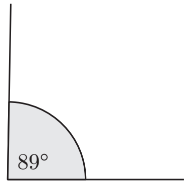
c $X\widehat{T}V = X\widehat{T}W + W\widehat{T}V$
$= 18° + 27°$
$= 45°$

d $S\widehat{T}W = S\widehat{T}U + U\widehat{T}V + V\widehat{T}W$
$= 25° + 32° + 27°$
$= 84°$

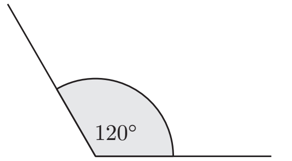
4 **a**



b



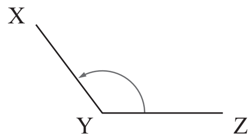
c



5 **a** **i** $B\widehat{A}D$ is b. **ii** $D\widehat{B}C$ is g. **iii** $A\widehat{D}B$ is d.

b **i** f is a reflex angle. **ii** a is an obtuse angle. **iii** h is an acute angle.

6 **a**



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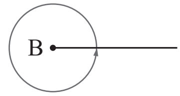

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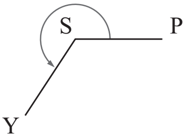
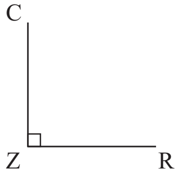
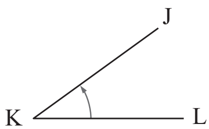


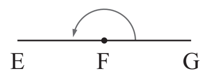
d



e

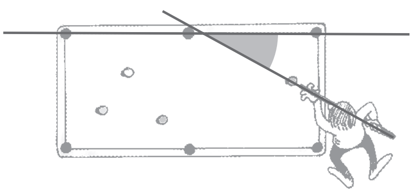


f



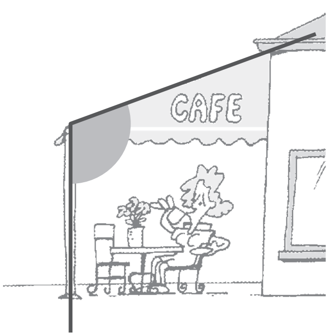
7 **a** **i** 68° **ii** 117° **iii** 112° **b** **i** 70° **ii** 80° **iii** 65°

8



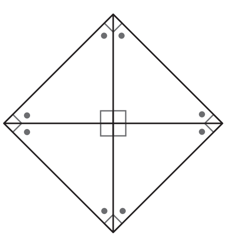
The acute angle is shaded on the diagram.
This angle measures $\approx 28.5°$.

9



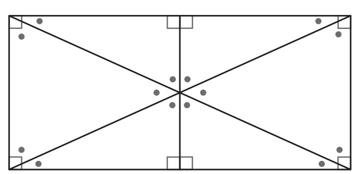
The angle between the roof of the awning and the post is shaded on the diagram.
This angle measures 110°.

10 **a**



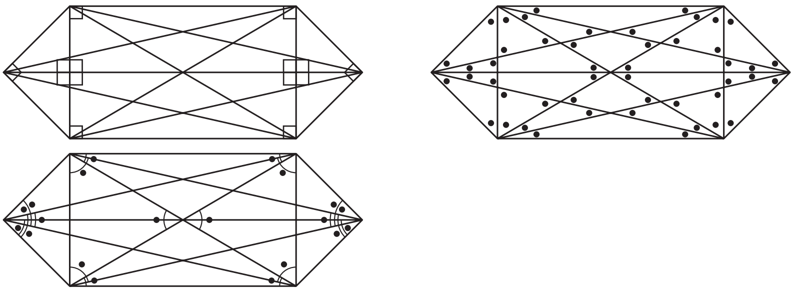
i There are 8 right angles.
ii There are 8 acute angles, marked •.

b



i There are 8 right angles.
ii There are 14 acute angles, marked •.

c



i There are 14 right angles.

ii There are 68 acute angles, marked ●.

EXERCISE 2C

1 **a** $109° + 71° = 180°$
$\therefore$ the angles are supplementary.

b $67° + 117° = 184°$
$\therefore$ the angles are neither complementary nor supplementary.

c $62° + 28° = 90°$
$\therefore$ the angles are complementary.

d $155° + 31° = 186°$
$\therefore$ the angles are neither complementary nor supplementary.

e $25° + 55° = 80°$
$\therefore$ the angles are neither complementary nor supplementary.

f $64° + 116° = 180°$
$\therefore$ the angles are supplementary.

2 **a** The size of the angle complementary to 15° is $90° - 15° = 75°$.

b The size of the angle complementary to 87° is $90° - 87° = 3°$.

c The size of the angle complementary to 43° is $90° - 43° = 47°$.

3 **a** The size of the angle supplementary to 129° is $180° - 129° = 51°$.

b The size of the angle supplementary to 57° is $180° - 57° = 123°$.

c The size of the angle supplementary to 90° is $180° - 90° = 90°$.

4 **a** $C\widehat{O}A$ and $C\widehat{O}E$ form the straight angle $A\widehat{O}E$.

$\therefore$ $C\widehat{O}A$ and $C\widehat{O}E$ are supplementary.

b $A\widehat{O}D$ and $E\widehat{O}C$ overlap, and form neither a 90° angle nor a 180° angle.

$\therefore$ $A\widehat{O}D$ and $E\widehat{O}C$ are neither complementary nor supplementary.

c $B\widehat{O}C$ and $C\widehat{O}D$ form the right angle $B\widehat{O}D$.

$\therefore$ $B\widehat{O}C$ and $C\widehat{O}D$ are complementary.

d $C\widehat{O}E$ and $D\widehat{O}B$ overlap, and form neither a 90° angle nor a 180° angle.

$\therefore$ $C\widehat{O}E$ and $D\widehat{O}B$ are neither complementary nor supplementary.

5 **a** The size of the angle complementary to $x°$ is $(90 - x)°$.

b The size of the angle supplementary to $y°$ is $(180 - y)°$.

6 **a** We have angles on a line,
$\therefore$ the sum of the angles is 180°.
$\therefore$ the unknown angle must be
$180° - 55° = 125°$
$\therefore$ $p = 125$

b We have angles in a right angle,
$\therefore$ the sum of the angles is 90°.
$\therefore$ the unknown angle must be
$90° - 52° = 38°$
$\therefore$ $q = 38$

c We have angles on a line,
$\therefore$ the sum of the angles is $180°$.
$\therefore$ the unknown angle must be
$180° - 39° - 47° = 94°$
$\therefore\ k = 94$

d We have angles on a line,
$\therefore$ the sum of the angles is $180°$.
$\therefore$ the unknown angle must be
$180° - 41° - 54° = 85°$
$\therefore\ b = 85$

e We have angles in a right angle,
$\therefore$ the sum of the angles is $90°$.
$\therefore$ the two equal angles add to
$90° - 38° = 52°$.
So, each must be $52° \div 2 = 26°$
$\therefore\ q = 26$

f We have angles on a line,
$\therefore$ the sum of the angles is $180°$.
$\therefore$ the two equal angles add to
$180° - 90° = 90°$.
So, each must be $90° \div 2 = 45°$
$\therefore\ t = 45$

g We have angles in a right angle,
$\therefore$ the sum of the angles is $90°$.
$\therefore$ the three equal angles add to
$90° - 27° = 63°$.
So, each must be $63° \div 3 = 21°$
$\therefore\ s = 21$

h We have angles on a line,
$\therefore$ the sum of the angles is $180°$.
So, each angle must be $180° \div 2 = 90°$
$\therefore\ a = 90$

i We have angles in a right angle,
$\therefore$ the sum of the angles is $90°$.
So, each angle must be $90° \div 3 = 30°$
$\therefore\ g = 30$

7 **a** We have angles at a point,
$\therefore$ the sum of the angles is $360°$.
$\therefore$ the unknown angle must be
$360° - 94° = 266°$
$\therefore\ r = 266$

b We have angles at a point,
$\therefore$ the sum of the angles is $360°$.
$\therefore$ the unknown angle must be
$360° - 240° = 120°$
$\therefore\ z = 120$

c We have angles at a point,
$\therefore$ the sum of the angles is $360°$.
$\therefore$ the unknown angle must be
$360° - 124° = 236°$
$\therefore\ m = 236$

8 **a** We have angles at a point,
$\therefore$ the sum of the angles is $360°$.
$\therefore$ the unknown angle must be
$360° - 209° - 101° = 50°$
$\therefore\ s = 50$

b We have angles at a point,
$\therefore$ the sum of the angles is $360°$.
$\therefore$ the unknown angle must be
$360° - 30° - 69° - 146° = 115°$
$\therefore\ b = 115$

c We have angles at a point,
$\therefore$ the sum of the angles is $360°$.
$\therefore$ the unknown angle must be
$360° - 103° - 95° - 131° = 31°$
$\therefore\ m = 31$

d We have angles at a point,
$\therefore$ the sum of the angles is $360°$.
$\therefore$ the unknown angle must be
$360° - 56° - 104° - 50° = 150°$
So, each angle must be $150° \div 2 = 75°$
$\therefore\ s = 75$

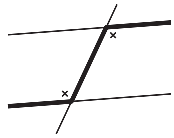
e We have angles at a point,
$\therefore$ the sum of the angles is $360°$.
$\therefore$ the two equal angles must be
$360° - 38° = 322°$
So, each angle must be $322° \div 2 = 161°$
$\therefore\ j = 161$

EXERCISE 2D

1 **a** b and d are vertically opposite angles.
a and c are vertically opposite angles.

b s and r are vertically opposite angles.
p and q are vertically opposite angles.

2 Alternate angles are on opposite sides of the transversal and between the two straight lines.
So, s and t are alternate angles in diagrams **B** and **C**.



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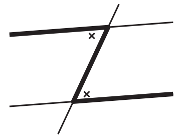
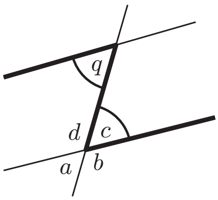


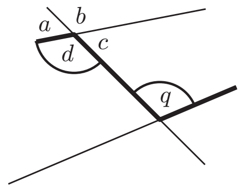
(or some rotation of these)

3 **a**



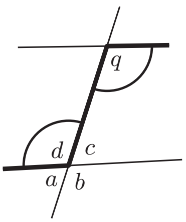
$\therefore$ angle c is alternate to angle q.

b



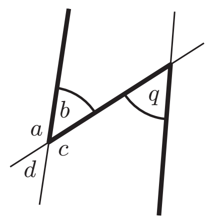
$\therefore$ angle d is alternate to angle q.

c



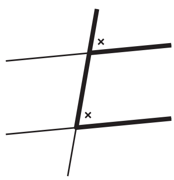
$\therefore$ angle d is alternate to angle q.

d



$\therefore$ angle b is alternate to angle q.

4 Corresponding angles are on the same side of the transversal and the same side of the two straight lines.
So, m and n are corresponding angles in diagrams **A**, **C**, and **D**.



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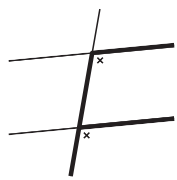

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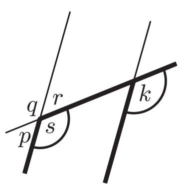
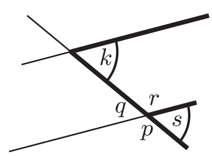
5 **a**



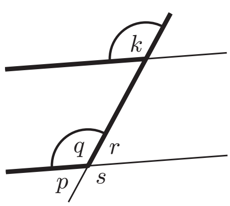
$\therefore$ angle s is corresponding to angle k.

b



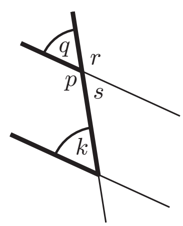
$\therefore$ angle s is corresponding to angle k.

c



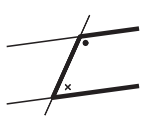
$\therefore$ angle q is corresponding to angle k.

d



$\therefore$ angle q is corresponding to angle k.

6 Co-interior angles are on the same side of the transversal and between the two straight lines.
So, c and d are co-interior angles in diagrams **B** and **D**.



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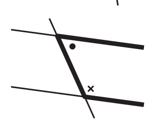
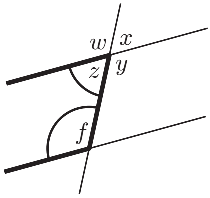


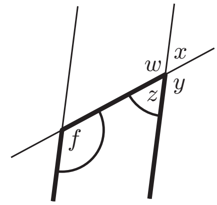
(or some rotation of these)

7 **a**



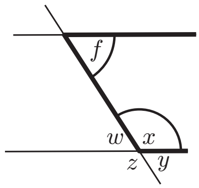
$\therefore$ angle z is co-interior to angle f.

b



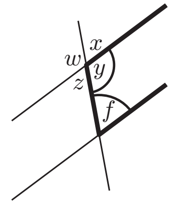
$\therefore$ angle z is co-interior to angle f.

c



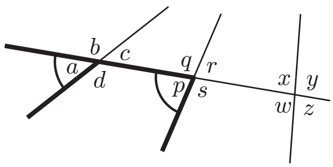
$\therefore$ angle x is co-interior to angle f.

d



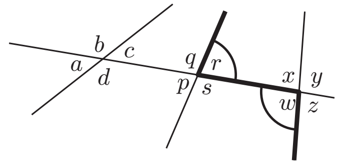
$\therefore$ angle y is co-interior to angle f.

8 **a**



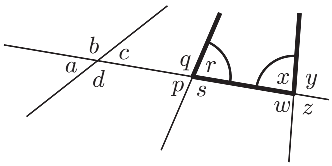
$\therefore$ a and p are corresponding angles.

b



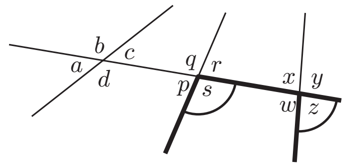
$\therefore$ r and w are alternate angles.

c



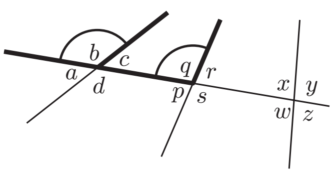
$\therefore$ r and x are co-interior angles.

d



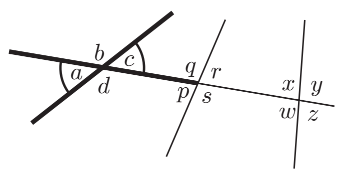
$\therefore$ z and s are corresponding angles.

e



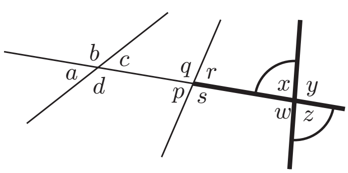
$\therefore$ b and q are corresponding angles.

f



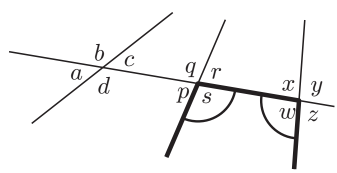
$\therefore$ a and c are vertically opposite angles.

g



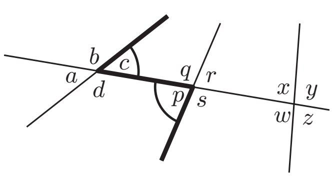
$\therefore$ x and z are vertically opposite angles.

h



$\therefore$ w and s are co-interior angles.

i



$\therefore$ c and p are alternate angles.

EXERCISE 2E

1 **a** $x = 124$ {corresponding angles are equal with parallel lines}

b Co-interior angles on parallel lines add to $180°$.

$\therefore$ the unknown angle is $180° - 98° = 82°$

$\therefore \quad b = 82$

c $q = 42$ {alternate angles are equal with parallel lines}

d $y = 57$ {corresponding angles are equal with parallel lines}

e $k = 62$ {alternate angles are equal with parallel lines}

f $a = 135$ {corresponding angles are equal with parallel lines}

g $x = 147$ {alternate angles are equal with parallel lines}

h With parallel lines, co-interior angles add to $180°$.

$\therefore$ the unknown angle is $180° - 107° = 73°$

$\therefore \quad y = 73$

i $d = 15$ {corresponding angles are equal with parallel lines}

2 **a** $a = 76$ {vertically opposite angles}
Now, $a°$ and $b°$ are co-interior angles on parallel lines, so they add to $180°$.
But $a = 76$, so $b = 180 - 76$

$\therefore \quad b = 104$

b $a = 117$ {corresponding angles are equal with parallel lines}

$\therefore \quad b = 117$ {vertically opposite angles}

c $a = 38$ {vertically opposite angles}
$b = 38$ {corresponding angles are equal with parallel lines}

d $a°$ and $215°$ are angles at a point.

$\therefore$ the sum of the angles is $360°$.

$\therefore \quad a = 360 - 215 = 145$

$a°$ and $b°$ are co-interior angles with parallel lines, so they add to $180°$.
But $a = 145$

$\therefore \quad b = 180 - 145 = 35$

e Co-interior angles with parallel lines add to $180°$.

$\therefore \quad m = 180 - 84 = 96$

$m°$ and $n°$ are also co-interior with parallel lines, and so add to $180°$.
But $m = 96$

$\therefore \quad n = 180 - 96 = 84$

f $a = 36$ {equal corresponding angles with parallel lines}
$a°$ and $b°$ are alternate angles with parallel lines, and so are equal.

$\therefore \quad b = 36$

3 **a** $x°$ and $y°$ are alternate angles with parallel lines, and so are equal.

$\therefore \quad x = y$

b $a°$ and $b°$ are co-interior angles with parallel lines, and so add to $180°$.

$\therefore \quad a + b = 180$

c $p°$ and $q°$ are corresponding angles with parallel lines, and so are equal.

$\therefore \quad p = q$

d $c°$ is alternate to $(a + b)°$, and since we have alternate angles with parallel lines, they must be equal.

$\therefore \quad a + b = c$

4 **a** These alternate angles are equal.

$\therefore$ the lines are parallel.

b These co-interior angles do not add to $180°$ $(105° + 105° = 210°)$.

$\therefore$ the lines are not parallel.

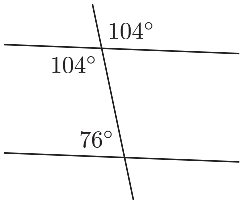
c These alternate angles are not equal.

$\therefore$ the lines are not parallel.

d These corresponding angles are equal.

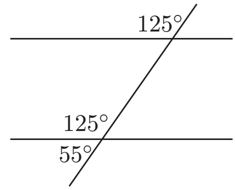
$\therefore$ the lines are parallel.

e



$104°$ and $76°$ are co-interior
{using vertically opposite angles}
and $104° + 76° = 180°$
$\therefore$ the lines are parallel.

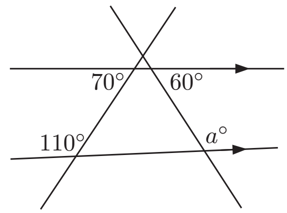
f



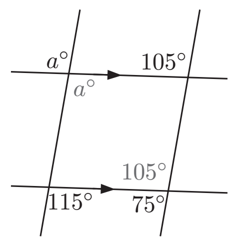
The angle supplementary to $55°$ is $180° - 55° = 125°$. {using angles on a line}
There is a pair of equal corresponding angles, so the lines are parallel.

5 **a** Using the co-interior angles of $110°$ and $70°$, $110° + 70° = 180°$.
$\therefore$ there is a pair of parallel lines as shown.
$60°$ and $a°$ are co-interior angles on this pair of parallel lines, and so must add to $180°$.

$\therefore\ a = 180 - 60$
$= 120$



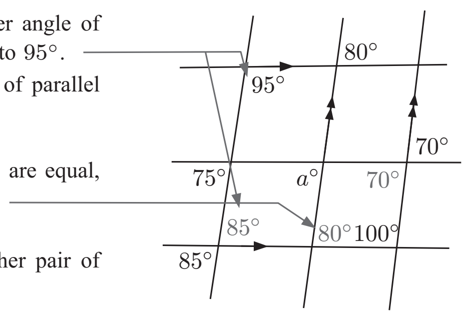
b The angle supplementary to $75°$ is $180° - 75° = 105°$.
We mark another angle of $105°$ on the diagram.
These corresponding angles of $105°$ are equal.
$\therefore$ the two lines marked are parallel.
(**Note:** The other pair of lines are *not* parallel, as the co-interior angles $115°$ and $75°$ do *not* add to $180°$.)



Using vertically opposite angles, $a°$ and $115°$ are corresponding angles with parallel lines, so they are equal.
$\therefore\ a = 115$

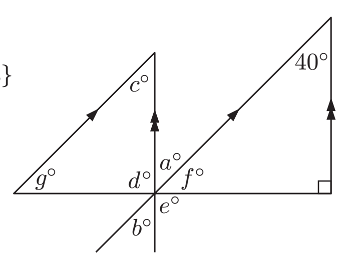
6 Using vertically opposite angles, mark another angle of $85°$ on the diagram. This angle is co-interior to $95°$.
Since $95° + 85° = 180°$, there is a pair of parallel lines (marked on the diagram).

Since corresponding angles with parallel lines are equal, we can mark in another $80°$ angle as shown.
This means that $80°$ is co-interior to $100°$.
Since $100° + 80° = 180°$, there is another pair of parallel lines (marked on the diagram).



Using vertically opposite angles, $70°$ and $a°$ are corresponding angles with parallel lines, so they are equal.
$\therefore\ a = 70$

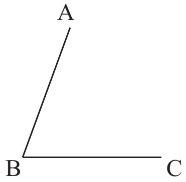
7 $a = 40$ {equal alternate angles with parallel lines}
$\therefore\ b = 40$ {vertically opposite angles}
$\therefore\ c = 40$ {equal corresponding angles b and c with parallel lines}
$d = 90$ {equal corresponding angles with parallel lines}
$e = 90$ {vertically opposite angles}



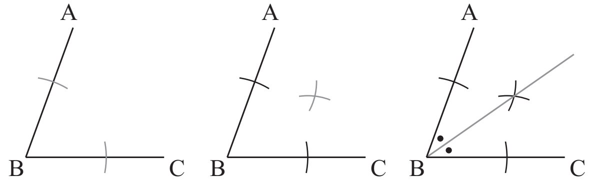
Now, $d°$, $a°$, and $f°$ are angles on a line, and so they add to $180°$.
But $a = 40$ and $d = 90$
$\therefore\ f = 180 - 40 - 90 = 50$
$\therefore\ g = 50$ {equal corresponding angles with parallel lines}

EXERCISE 2F

1 **a**

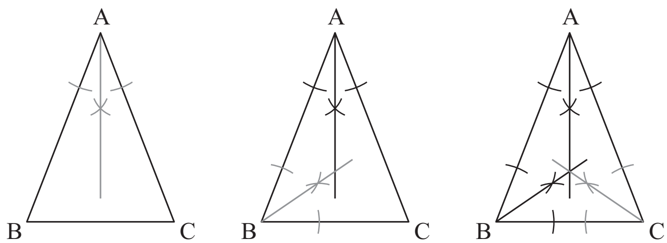


b

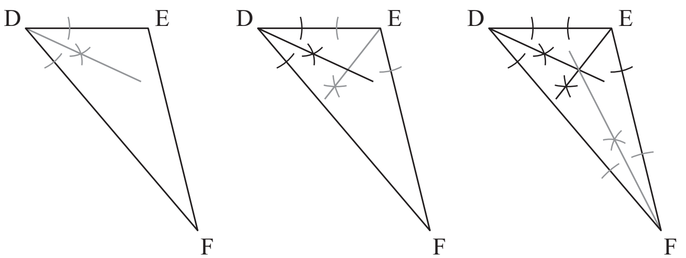


c Using a protractor, each angle • above measures 35°.

2 **a**



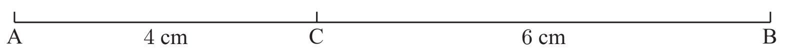
b



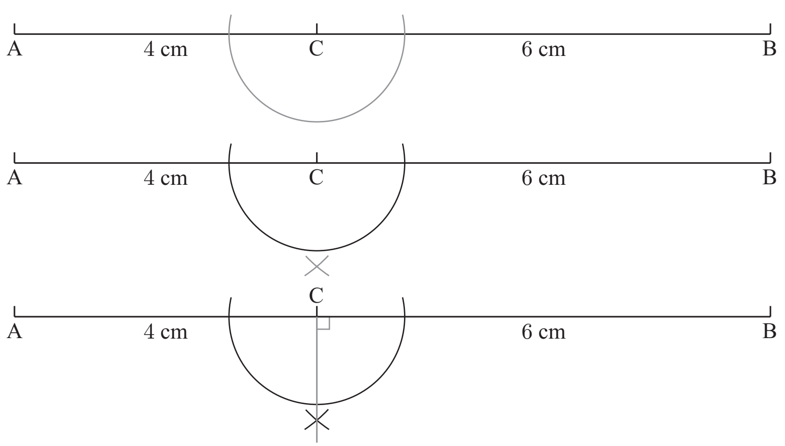
c You should find that no matter what triangle is drawn, its angle bisectors all meet at the same point.

d The three angle bisectors of a triangle are concurrent.

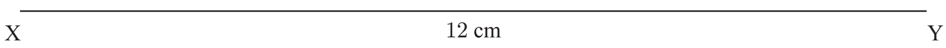
3 **a**



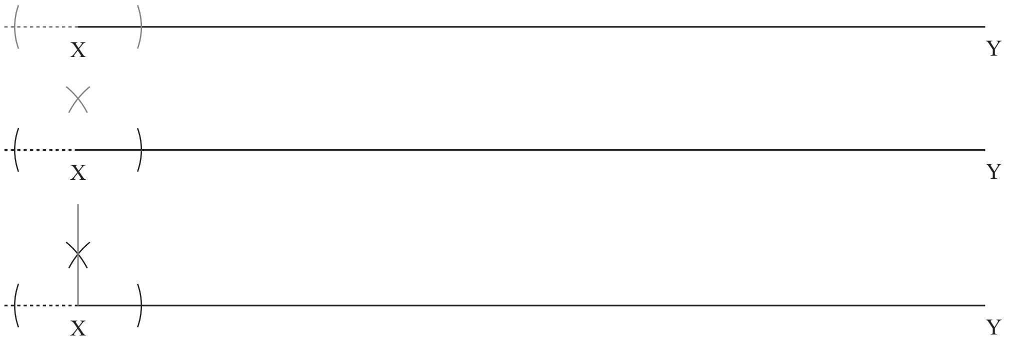
b



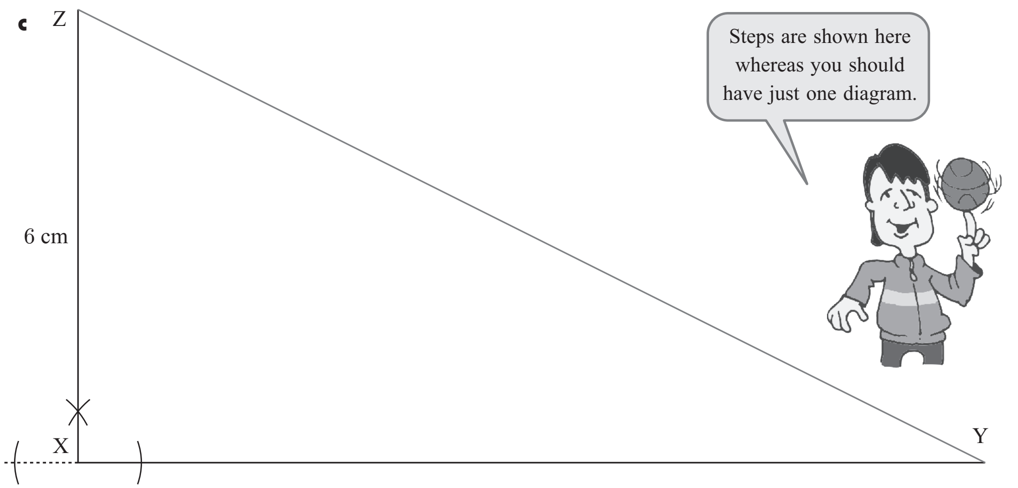
4 **a**



b

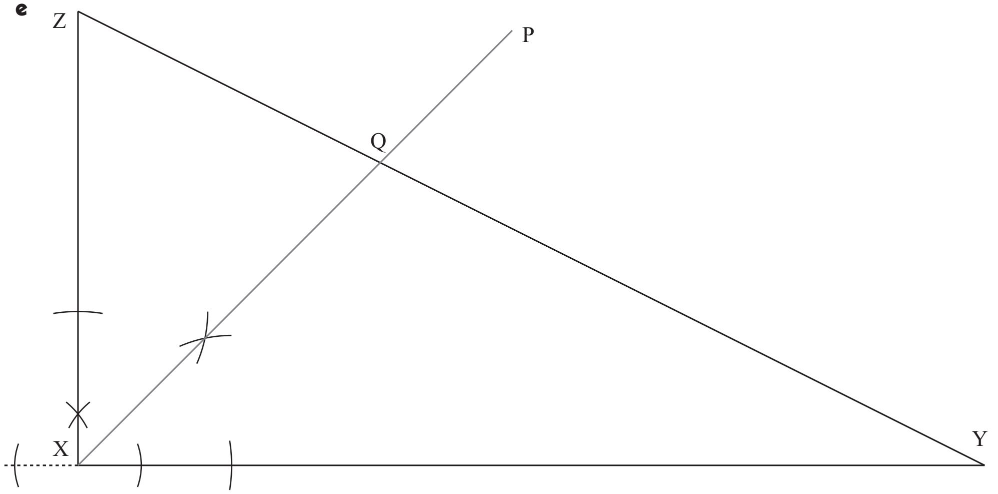


c



d Using a ruler, the length of [ZY] is 134 mm.

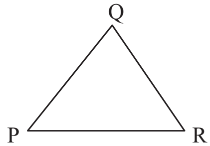
e

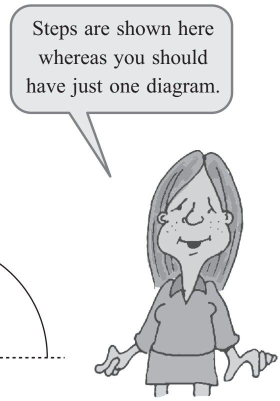


f **i** Using a ruler, the length of [QY] is 89 mm.

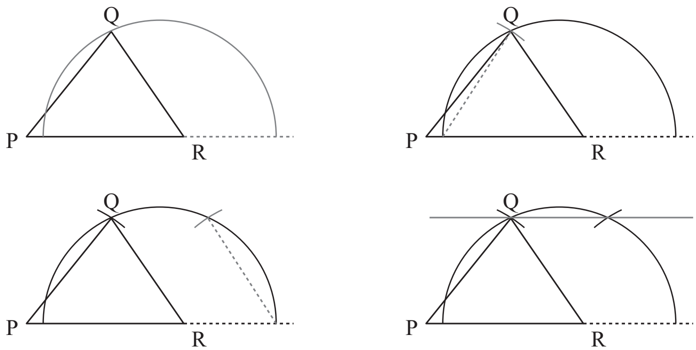
ii Using a protractor, the measure of angle $X\widehat{Q}Y$ is $108°$.

5 **a**

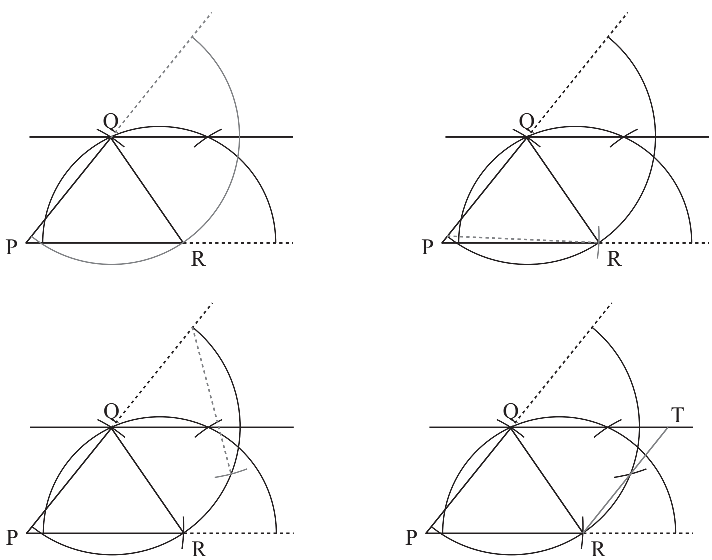




b



c



d Using a protractor, $R\widehat{Q}T$ and $P\widehat{R}Q$ are both equal. (Their exact measure will depend on the original triangle PQR.)

$R\widehat{Q}T$ and $P\widehat{R}Q$ are alternate angles, with PR parallel to QT.

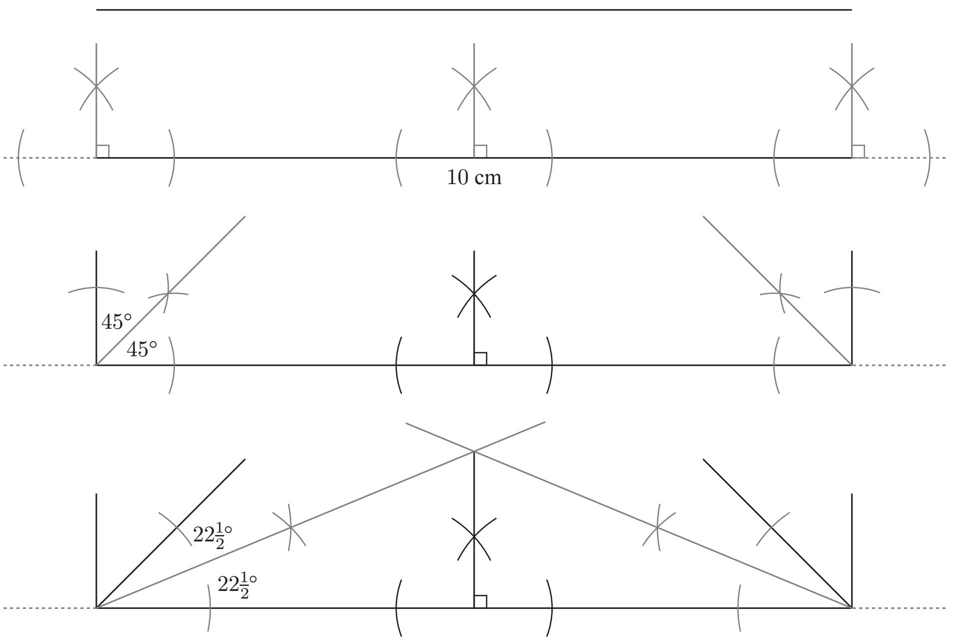
When lines are parallel, alternate angles are equal in size.

e Using a protractor, $Q\widehat{T}R$ and $P\widehat{R}T$ add to $180°$, that is, they are supplementary. (Their exact measure will depend on the original triangle PQR.)

$Q\widehat{T}R$ and $P\widehat{R}T$ are co-interior angles, with PR parallel to QT.

When lines are parallel, co-interior angles are supplementary.

6 Use the scale 1 cm represents 1 m.
Construct perpendicular lines at the endpoints and the midpoint of the 10 cm length.
Bisect the right angles at the endpoints, then bisect the 45° angles as shown.



REVIEW SET 2

1 **a** The angle complementary to 41° is $90° - 41° = 49°$.

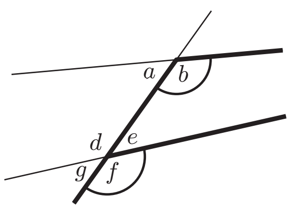
b One revolution is 360°.

c Using a protractor, $A\widehat{B}C = 33°$.

2 **a** The angle complementary to 53°
$= 90° - 53°$
$= 37°$

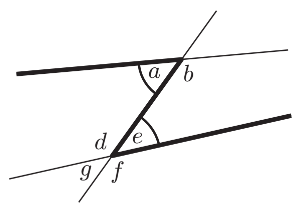
b The angle supplementary to 130°
$= 180° - 130°$
$= 50°$

3 **a**



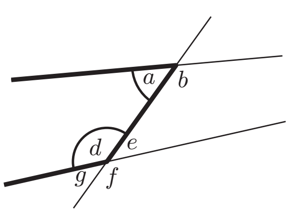
Angle f is corresponding to angle b.

b



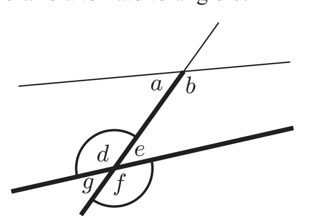
Angle a is alternate to angle e.

c



Angle d is co-interior to angle a.

d



Angle d is vertically opposite angle f.

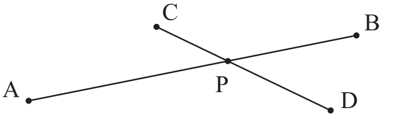
4 **a** We have angles in a right angle,
$\therefore$ the sum of the angles is $90°$.
$\therefore$ the three equal angles add to
$90° - 42° = 48°$
So, each angle must be $48° \div 3 = 16°$
$\therefore\ a = 16$

b We have angles at a point,
$\therefore$ the sum of the angles is $360°$.
$\therefore$ the unknown angle must be
$360° - 144° - 90° - 99° = 27°$
$\therefore\ b = 27$

c We have angles on a straight line,
$\therefore$ the sum of the angles is $180°$.
$\therefore$ the unknown angle must be
$180° - 43° - 17° = 120°$
$\therefore\ c = 120$

5 If you have any two points you can only draw one straight line through them.
So, two points are needed to determine the position of a line.

6



7 **a** Using vertically opposite angles, $118°$ and $x°$ are co-interior angles with parallel lines.
$\therefore$ the unknown angle must be $180° - 118° = 62°$
$\therefore\ x = 62$

b $x = 61$ {equal alternate angles with parallel lines}

c The angles $(100 + 26)°$ and $(x + 38)°$ are vertically opposite angles, and so are equal.
$\therefore\ (x + 38)°$ is equal to $126°$
$\therefore$ the unknown angle must be $126° - 38° = 88°$
$\therefore\ x = 88$

8 **a** Point T also lies on line (RS).
So, the line could also be named in the following ways (pick any two):
(RT), (SR), (ST), (TR), (TS)

b (PR) and (PS). Note that (PR) can also be listed as (PQ), (QP), (QR), (RP), and (RQ); and (PS) can be listed as (PU), (UP), (US), (SU), and (SP).

c **i** Points P, Q, and R lie on the same straight line.
$\therefore$ P, Q, and R are collinear.

ii Lines (PQ) and (RS) are concurrent at R.

9 **a** $m = 116$ {equal alternate angles with parallel lines}

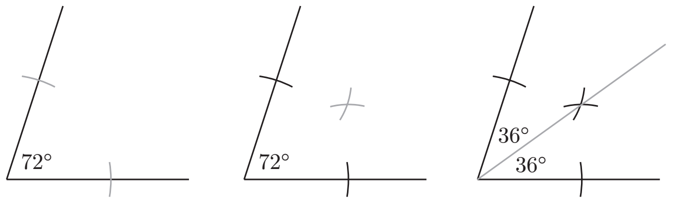
b $m = 81$ {equal corresponding angles with parallel lines}

c $m°$ and $39°$ are co-interior angles with parallel lines, and so they add to $180°$.
$\therefore$ the unknown angle is $180° - 39° = 141°$
$\therefore\ m = 141$

10 **a** Using vertically opposite angles, $x°$ and $y°$ are corresponding angles with parallel lines, and so are equal.
$\therefore\ x = y$

b $a°$ and $b°$ are co-interior angles with parallel lines, and so add to $180°$.
$\therefore\ a + b = 180$

11



Using a protractor, the two angles produced each measure $36°$.

12 **a** Using vertically opposite angles, we have equal corresponding angles of $91°$.
$\therefore$ [AB] is parallel to [CD].

b Reflex $B\widehat{D}C$ is $306°$, so $B\widehat{D}C = 360° - 306°$
$= 54°$ {angles at a point}

$A\widehat{B}D$ and $B\widehat{D}C$ have a sum of $126° + 54° = 180°$.
$\therefore$ $A\widehat{B}D$ and $B\widehat{D}C$ are co-interior angles and are supplementary.
$\therefore$ [AB] is parallel to [CD].

PRACTICE TEST 2A

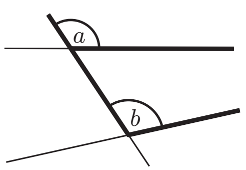
1 Line l could be named in any of the following ways:
(AE), (AD), (EA), (ED), (DA), (DE)
$\therefore$ the answer is **D**.

2 $A\widehat{B}C$ is clearly more than $90°$ and less than $180°$ (a straight line).
$\therefore$ $A\widehat{B}C$ is an obtuse angle.
$\therefore$ the answer is **C**.

3 $R\widehat{Q}T = R\widehat{Q}S + S\widehat{Q}T$
$= 25° + 48°$
$= 73°$
$\therefore$ the answer is **B**.

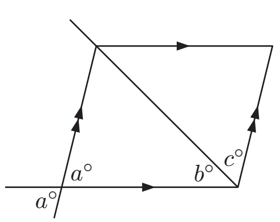
4 We have angles at a point,
$\therefore$ the sum of the angles is $360°$.
$\therefore$ the two equal angles add to $360° - 90° - 130° = 140°$
$\therefore$ each angle is $140° \div 2 = 70°$
$\therefore$ $x = 70$
$\therefore$ the answer is **D**.

5



a and b are corresponding angles.
$\therefore$ the answer is **C**.

6



Using vertically opposite angles, $a°$ is co-interior with $(b+c)°$ on parallel lines, and so the angles add to $180°$.
$\therefore$ $a° + (b+c)° = 180°$
$\therefore$ $a + b + c = 180$
$\therefore$ the answer is **B**.

7 We have angles on a straight line,
$\therefore$ the angles add to $180°$.
$\therefore$ the unknown angle is $180° - 42° - 47° - 31° = 60°$
$\therefore$ $y = 60$
$\therefore$ the answer is **B**.

8 The angle marked $\times$ is $B\widehat{C}A$ (or $A\widehat{C}B$).
$\therefore$ the answer is **A**.

9 The angle complementary to 28° is
$90° - 28° = 62°$.
$\therefore$ the answer is **C**.

10 In the diagram given:

- $A\widehat{B}E$ and $B\widehat{E}D$ are equal in measure {alternate angles are equal with parallel lines}
- $B\widehat{E}F$ and $C\widehat{B}E$ are alternate angles
- Since $B\widehat{C}D$ and $C\widehat{D}F$ are co-interior angles with parallel lines, they add to 180°.
  $\therefore$ $C\widehat{D}F = 180° - 90° = 90°$
- $A\widehat{B}E$ and $A\widehat{C}D$ are corresponding angles
- $C\widehat{B}E$ is clearly acute, but $B\widehat{E}D$ is obtuse

$\therefore$ statement **E** is not true.

PRACTICE TEST 2B

1 **a** Point C also lies on (AB).
$\therefore$ (AB) can also be named in the following ways (pick any two): (AC), (BA), (BC), (CA), (CB).

b **i** Points A, B, and C lie on the same straight line.
$\therefore$ A, B, and C are collinear.

ii Lines (AD) and (BD) are concurrent at D.

2 **a** $x = 110$ {corresponding angles are equal with parallel lines}

b We have angles at a point, $\therefore$ the angles add to 360°.
$\therefore$ the unknown angle is $360° - 81° - 153° = 126°$
$\therefore$ $c = 126$

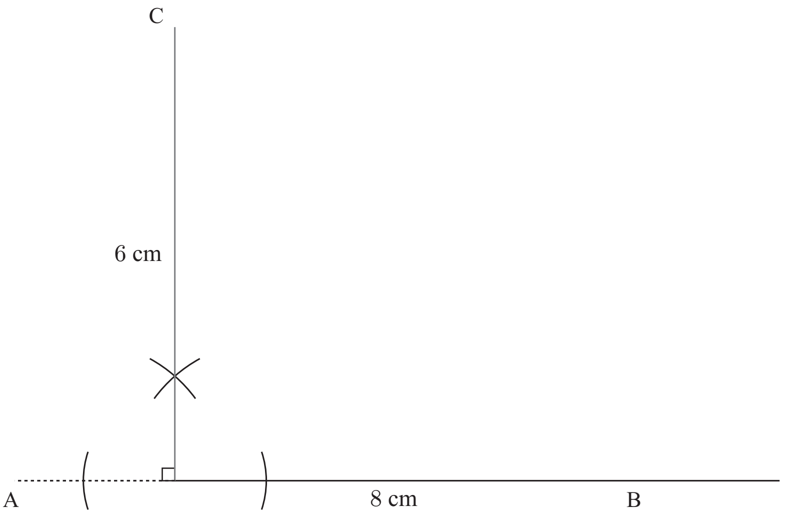
3 **a** The angle complementary to 65° is $90° - 65° = 25°$.

b The angle supplementary to 88° is $180° - 88° = 92°$.

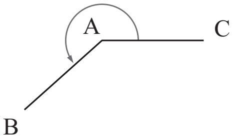
4 **a** We have angles in a right angle,
$\therefore$ the angles add to 90°
$\therefore$ the unknown angle is $90° - 55° = 35°$
$\therefore$ $a = 35$

b We have angles on a line,
$\therefore$ the four equal angles add to 180°.
$\therefore$ each angle is $180° \div 4 = 45°$
$\therefore$ $b = 45$

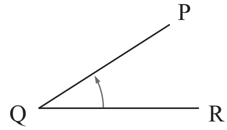
5



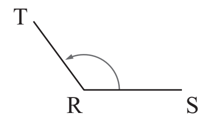
6 **a**



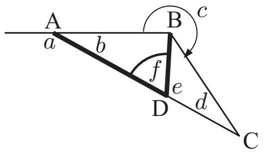
b



c

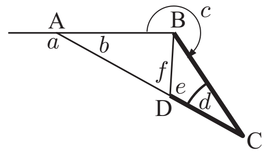


7 **a** **i**



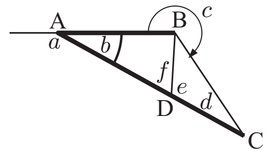
$\therefore$ the angle is f.

ii



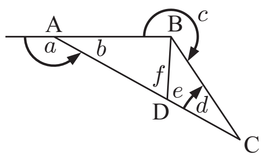
$\therefore$ the angle is d.

iii



$\therefore$ the angle is b.

b



i Angle c is reflex.
ii Angle a is obtuse.
iii Angle d is acute.

8 **a** Using a protractor, reflex $P\widehat{Q}R$ measures $338°$.

b We have angles at a point, $\therefore$ the angles add to $360°$.

$\therefore$ acute $P\widehat{Q}R$ measures $360° - 338° = 22°$.

9 **a** $B\widehat{H}D$ and $D\widehat{H}E$ are angles on a line, so they add to $180°$.

$\therefore$ $B\widehat{H}D = 180° - 90° = 90°$

But $B\widehat{H}D = B\widehat{H}C + C\widehat{H}D$, so $B\widehat{H}C + C\widehat{H}D = 90°$

$\therefore$ $B\widehat{H}C$ and $C\widehat{H}D$ are complementary.

b $A\widehat{H}G$ and $A\widehat{H}B$ are not angles in a right angle, and are not angles on a straight line.

$\therefore$ $A\widehat{H}G$ and $A\widehat{H}B$ are neither complementary nor supplementary.

c $C\widehat{H}A$ and $C\widehat{H}D$ are angles on the line segment [AD].

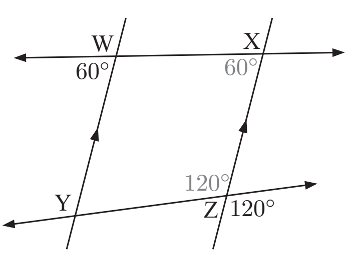
$\therefore$ they add to $180°$.

$\therefore$ $C\widehat{H}A$ and $C\widehat{H}D$ are supplementary.

d $B\widehat{H}C$ and $E\widehat{H}G$ are vertically opposite, and therefore equal in size.
However, we are given no further information.

So, $B\widehat{H}C$ and $E\widehat{H}G$ are neither complementary nor supplementary.

10



$X\widehat{Z}Y = 120°$ {vertically opposite angles}
$W\widehat{X}Z = 60°$ {equal corresponding angles with parallel lines}

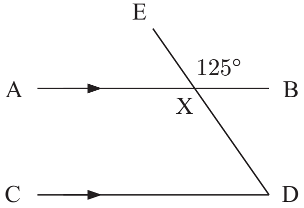
So, we have co-interior angles $W\widehat{X}Z$ and $X\widehat{Z}Y$ that add to $60° + 120° = 180°$.

$\therefore$ $W\widehat{X}Z$ and $X\widehat{Z}Y$ are supplementary.

$\therefore$ (WX) is parallel to (YZ).

PRACTICE TEST 2C

1 **a**



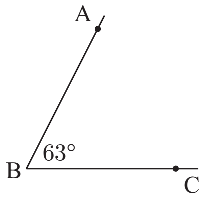
b **i** $A\widehat{X}D = 125°$ {vertically opposite angles}

ii $A\widehat{X}D$ and $X\widehat{D}C$ are co-interior angles with parallel lines,

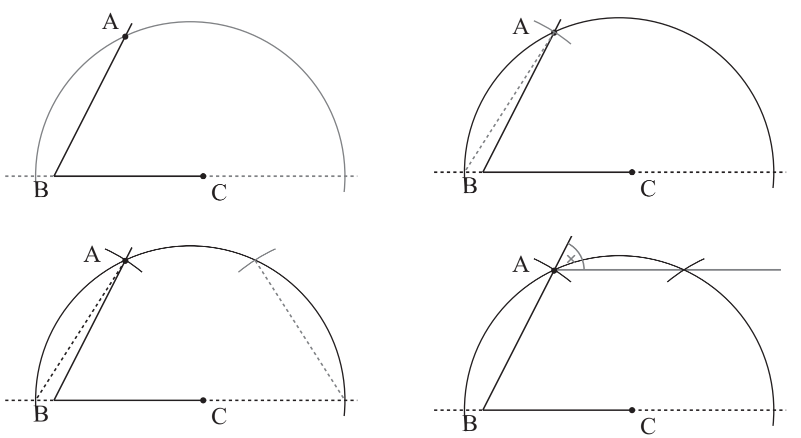
$\therefore$ the angles add to 180°

$\therefore$ $X\widehat{D}C = 180° - 125°$
$= 55°$

2 **a**

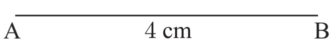


b

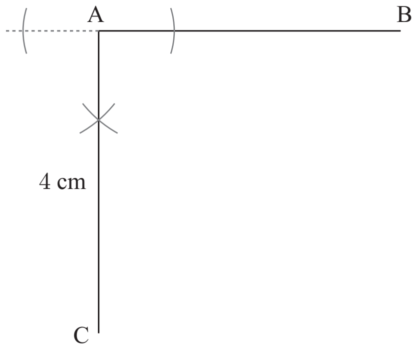


c Using a protractor, the acute angle marked with × above measures 63°.
(You would expect this as we have corresponding angles with parallel lines.)

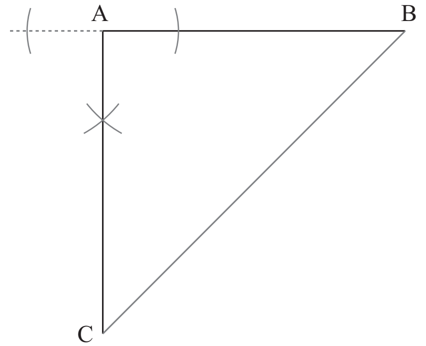
3 **a**



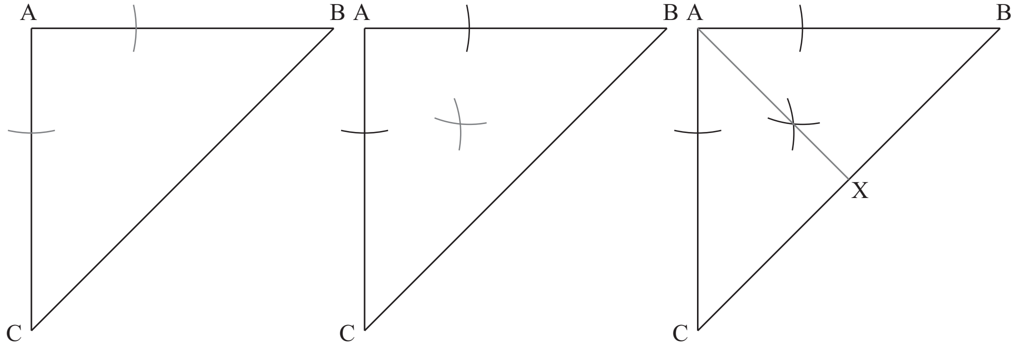
b



c

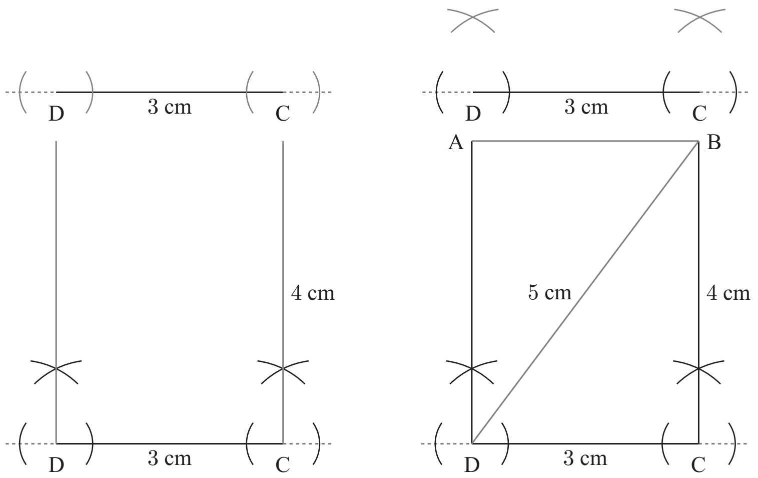


d



e Using a protractor, $A\widehat{X}B$ measures 90°.
So, the angle bisector of $C\widehat{A}B$ meets [BC] at right angles.

4 **a**



b We need to find the measure of angle $C\widehat{B}D$.
Using a protractor, this angle measures 37°.

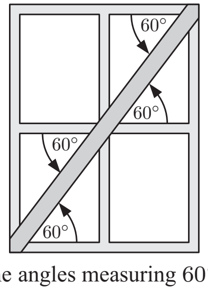
c We need to find the measure of angle $A\widehat{D}B$.
Using a protractor, this angle measures 37°.

d The two angles $C\widehat{B}D$ and $A\widehat{D}B$ are equal.

e Since $C\widehat{B}D$ and $A\widehat{D}B$ are equal alternate angles, [AD] and [BC] must be parallel.
This means that Andrew will never meet Barry.

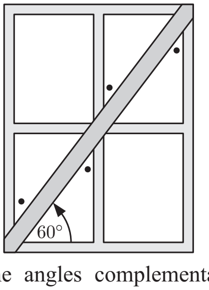
5 **a** Since the frame is rectangular, the horizontal parts are parallel and the vertical parts are parallel.
$\therefore$ the shaded angle is also 60° {equal corresponding angles with parallel lines}

b **i**



The angles measuring 60° are marked on the diagram.
Each of these is either alternate to or corresponding to the original 60°.

ii



The angles complementary to 60° are marked with a •.
Each of these angles is in a right angle with a 60° angle (see **b i**).