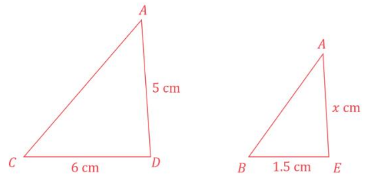
Q1

The triangles are similar so there will exist a value of k such that $AD = kAE$ and $CD = kBE$.
k is known as the scale factor.

It may help to draw the two triangles out separately next to each other.



Form an equation using the two known sides of the triangle.

$$CD = kBE$$

Substitute the values of CD and BE into the equation and solve to find k.

$$6 = 1.5k$$
$$k = \frac{6}{1.5} = 4$$

[1]

Substitute into $AD = kAE$.

$$AD = kAE$$
$$5 = (4)AE$$

Solve to find AE.

$$5 = 4AE$$
$$AE = \frac{5}{4} = 1.25$$

Solve to find AE.

$$5 = 4AE$$
$$AE = \frac{5}{4} = 1.25$$

$ED = AD - AE$.
Substitute the values of AD and AE in.

$$ED = AD - AE = 5 - 1.25$$

[1]

$ED = 3.75$ cm [1]

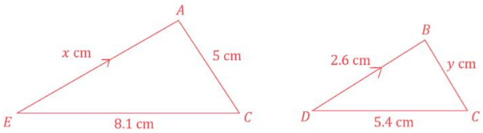
Q2

All of the corresponding angles in the triangles *AEC* and *BDC* are the same, as angle *BCD* is in both triangles, and the other angles are corresponding angles on parallel lines.

Triangles *AEC* and *BDC* are similar

The triangles are similar so there will exist a value of k such that $AE = kBD$, $CD = kCE$ and $BC = kAC$.
k is known as the scale factor.

It may help to draw the two triangles out separately next to each other.



Form an equation using the two known sides of the triangle.

$$CE = kCD$$

Substitute the values of CE and CD into the equation and solve to find k.

$$8.1 = 5.4k$$
$$k = \frac{8.1}{5.4} = \frac{3}{2}$$

[1

Substitute into $AE = kBD$.

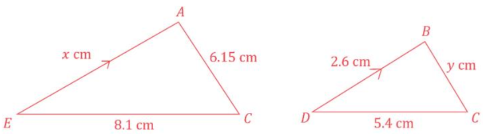
$$AE = kBD$$
$$x = \left(\frac{3}{2}\right)(2.6)$$

$$AE = kBD$$
$$x = \left(\frac{3}{2}\right)(2.6)$$

$AE = 3.9$ cm [1

2b

Add the new information to the diagram.



Find BC by substituting $k = \frac{3}{2}$ into $AC = kBC$.

$$AC = kBC$$
$$6.15 = \left(\frac{3}{2}\right)BC$$

Solve to find $BC\ (= y)$.

$$6.15 = \frac{3y}{2}$$
$$y = \frac{2(6.15)}{3} = 4.1$$

[1

$AB = AC - BC$.
Substitute the values of AC and BC in.

$AB = AC - BC$.
Substitute the values of AC and BC in.

$$AB = AC - BC = 6.15 - 4.1$$

$AB = 2.05$ cm [1]

Q3

The height of model **A** and the height of model **B** are corresponding lengths in similar shapes so find k, the scale factor, using $k = \frac{\text{second corresponding length}}{\text{first corresponding length}}$

Method 1

The height of model **B** is smaller than the height of model **A**. To go from the big shape to the small shape, put the small length on top in the fraction so that k will be smaller than 1

$$k = \frac{\text{height } \mathbf{B}}{\text{height } \mathbf{A}} = \frac{147}{187}$$

[1]

Find the height of model **B** by multiplying the height of model **A** by k (notice that $k < 1$ so multiplying by k will make the length smaller)

$$\text{height } \mathbf{B} = k[\text{height } \mathbf{A}] = \frac{147}{187} \times 90$$

[1]

$$= 70.7486631...$$

This answer is already in centimetres but give the final answer to the nearest centimetre as requested in the question

71 cm [1]

Method 2

Finding k using $k = \frac{\text{second corresponding length}}{\text{first corresponding length}}$, if you put the larger length on top of the fraction then;

$$k = \frac{\text{height } \mathbf{A}}{\text{height } \mathbf{B}} = \frac{187}{147}$$

Notice that $k > 1$ so multiplying by k will make the length bigger - but in going from the height of model **A** to the height of model of **B**, we want to go from a longer length to a smaller length. So divide by k instead

$$\text{height } \mathbf{B} = \text{height } \mathbf{A} \div k = 90 \div \frac{187}{147}$$

[1]

$$= 70.7486631...$$

This answer is already in centimetres but give the final answer to the nearest centimetre as requested in the question

71 cm [1]

Q4-5

This is an example of **intersecting chord theorem** therefore $PD \times PC = PB \times PA$

$$PD \times 8 = 6 \times 9$$

[1]

Find PD by dividing both sides by 8

$$PD = \frac{6 \times 9}{8}$$

PD = 6.75 cm [1]

5

QR and PR are corresponding sides in triangles QRS and PRT respectively. Connecting all three pairs of corresponding sides in this way we would have;

$$\frac{\text{smaller corresponding side}}{\text{larger corresponding side}} = \frac{QR}{PR} = \frac{SR}{TR} = \frac{QS}{PT}$$

$\frac{SR}{TR}$ is not given as an option but $\frac{QS}{PT}$ is.

The top right option is correct, $\frac{QS}{PT}$ [1]

The top left option, $\frac{RS}{ST}$, is incorrect as ST is not a complete side in the larger similar triangle.

The bottom two options, $\frac{PT}{QS}$ and $\frac{RT}{RS}$ are not correct as they both represent $\frac{\text{larger corresponding side}}{\text{smaller corresponding side}}$ - but the given ratio was $\frac{\text{smaller}}{\text{larger}}$.

Q6

Find an expression for angle *BAC*.

Angle *BAC* = Angle *CBQ* = x (Alternate segment theorem)

[1]

Find an expression for angle *ABC*.

Angle *ABC* = Angle *CBQ* = x (Because *BC* bisects angle *ABQ*)

[1]

Identify the type of triangle that triangle *ABC* is based on its properties.

Angle *BAC* = Angle *ABC*, so triangle *ABC* is an isosceles triangle [1]

Q7

7a

Angle DCE = $a°$ because it is **corresponding to angle BAC** [1]

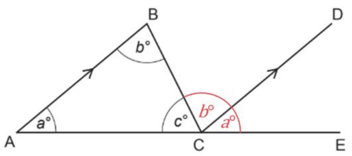
7b

Look for other angles that you can find using the parallel lines.

Angle BCD = $b°$ because it is alternate to angle ABC

Correctly identifying b° [1]
Correct reason [1]

Look at the angles at point C that form a straight line. They are the same three angles as the interior angles in the triangle.



$a° + b° + c° = 180°$ because angles that form a straight line add up to 180°

Therefore the angles in a triangle add up to 180° [1]

Q8

The two triangles will be be similar if they have the same corresponding angles.
Show that this is the case using angle facts in parallel lines.

Angle BAE = Angle EDC (alternate angles)

Angle ABE = Angle ECD (alternate angles)

Angle AEB = Angle CED (vertically opposite angles)

1 pair of angles with a correct statement [1]
2 pairs of angles with correct statements [1]

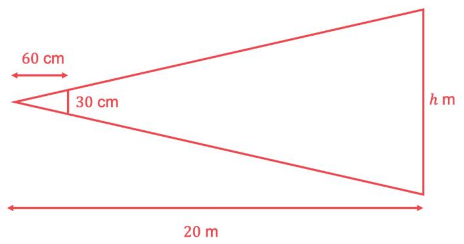
Triangle ABE and triangle CDE are similar as corresponding angles are equal [1]

The answer mark can be awarded only if no incorrect statements are seen

Q9

Method 1:

Two similar triangles are formed, one between the girl and the ruler and the other between the girl and the tree.



Find the ratio between the height of the ruler and its distance from the girl.

$$\frac{30}{60} = 0.5$$

[1]

The ratio of the height of the tree and its distance from the girl must be the same so compare the two values.

$$\frac{h}{20} = 0.5$$

Multiply the distance of the tree from the girl by the scale factor of 0.5 to find the height of the tree.

$$h = 0.5 \times 20$$

[1]

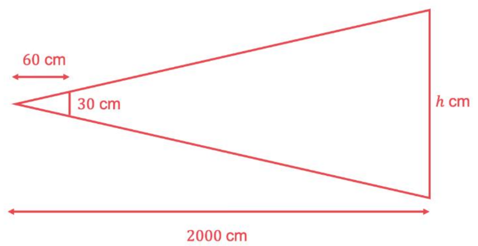
10 m [1]

Method 2:

Two similar triangles are formed, one between the girl and the ruler and the other between the girl and the tree.

Convert the distance between the girl and the tree from metres to centimetres by multiplying the distance by 100 and sketch a labelled diagram.

$$20 \times 100 = 2000$$



Compare the horizontal distance between the tree and the girl to find the length scale factor.

$$\frac{2000}{60} = \frac{100}{3}$$

[1]

Multiply the length of the ruler by the length scale factor to find the height of the tree.

$$30 \times \frac{100}{3} = 1000$$

Convert the height of the tree from centimetres to metres by dividing by 100.

$$\frac{1000}{100}$$

10 m [1]

9b

Give any two valid reasons.

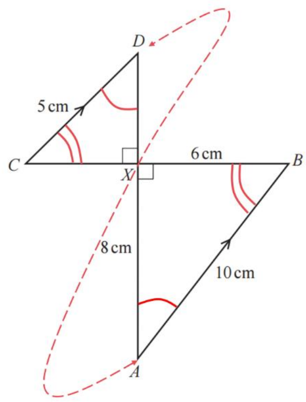
She would have to stand a very long distance from the building [1]

The estimate is likely to be inaccurate due to the scale factors at the distances involved [1]

Q10

Alternate angles in parallel lines are equal

The triangles are similar and reflected



NOT TO SCALE

Find the scale factor of enlargement (by dividing side *AB* by its corresponding side *CD*)

$$\text{scale factor} = \frac{10}{5} = 2$$

Find the corresponding side to *DX* (looking at the reflection)

Find the corresponding side to *DX* (looking at the reflection)

DX corresponds to *AX*

[1]

AX is a factor of 2 larger than *DX*
Find *DX* (by halving *AX*)

$$DX = \frac{8}{2}$$

4 cm [1]