5.18 Similar Shapes (Lengths): 2-hour Pack

EDEXCEL 1MA1 · Calculator allowed · about 120 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 A photograph measuring 10 cm by 15 cm is enlarged so that it fits exactly into a frame with a longer side of 45 cm. The enlarged photograph is mathematically similar to the original.

(a) Work out the scale factor of the enlargement. **(1)**

.....

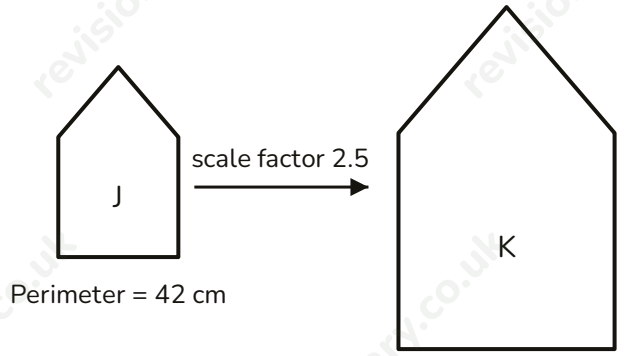
(b) Work out the length of the shorter side of the enlarged photograph. **(2)**

.....

(Total for Question 1 is 3 marks)

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2 Pentagon J and pentagon K are mathematically similar. The perimeter of pentagon J is 42 cm. The scale factor of enlargement from pentagon J to pentagon K is 2.5.



(a) Work out the perimeter of pentagon K. **(2)**

.....

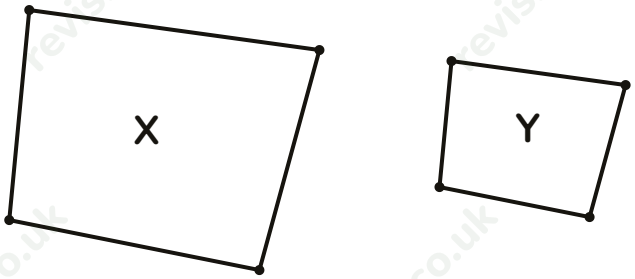
(b) One side of pentagon J has length 6 cm. Work out the length of the corresponding side of pentagon K. **(2)**

.....

(Total for Question 2 is 4 marks)

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3 Shape X and shape Y are mathematically similar. The scale factor of enlargement from shape X to shape Y is 3/5.



(a) A side of shape X has length 20 cm. Work out the length of the corresponding side of shape Y. **(2)**

.....

(b) A different side of shape Y has length 21 cm. Work out the length of the corresponding side of shape X. **(2)**

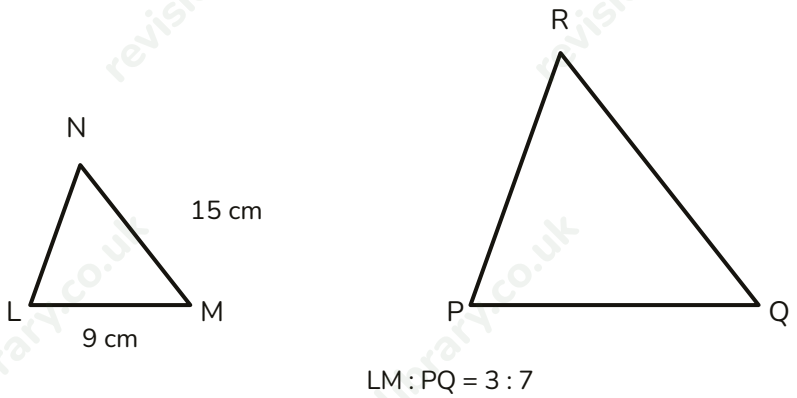
.....

(Total for Question 3 is 4 marks)

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4 Triangle LMN is similar to triangle PQR, with LM corresponding to PQ and MN corresponding to QR. LM : PQ = 3 : 7. LM = 9 cm and MN = 15 cm.

Diagram NOT accurately drawn



LM : PQ = 3 : 7

(a) Work out the length of PQ. **(2)**

.....

(b) Work out the length of QR. **(2)**

.....

(c) The perimeter of triangle PQR is 84 cm. Work out the perimeter of triangle LMN. **(2)**

.....

(Total for Question 4 is 6 marks)

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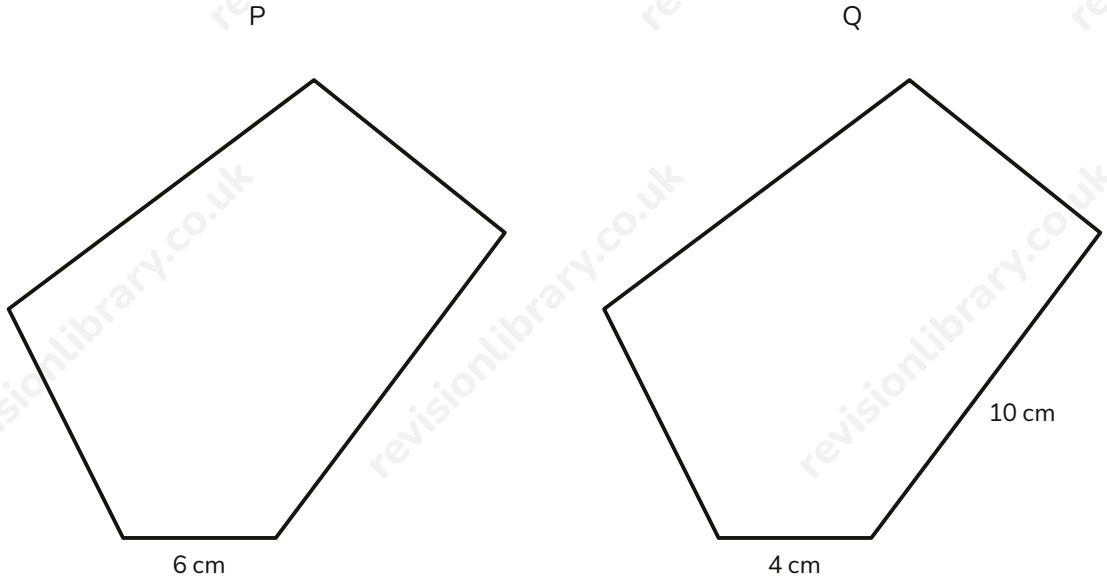
5 A rectangular banner with width 18 cm and height 30 cm is enlarged so that the new width is 39 cm. The enlargement is similar to the original. Work out the new height.

(Total for Question 5 is 2 marks)

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6 Shape P and shape Q are similar pentagons. A side of shape Q is 4 cm and the corresponding side of shape P is 6 cm. Another side of shape Q is 10 cm. Work out the length of the corresponding side of shape P.

Diagram NOT accurately drawn



(Total for Question 6 is 2 marks)

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7 At the same time, a girl of height 180 cm casts a shadow 120 cm long and a tree casts a shadow 600 cm long. Work out the height of the tree, in centimetres.

(Total for Question 7 is 3 marks)

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8 Shape P and shape Q are similar triangles. A side of shape Q is 12 cm and the corresponding side of shape P is 6 cm. Another side of shape Q is 8 cm. Work out the length of the corresponding side of shape P.

(Total for Question 8 is 2 marks)

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9 A poster with width 15 cm and height 20 cm is enlarged so that the new width is 27 cm. The enlargement is similar to the original. Work out the new height.

(Total for Question 9 is 2 marks)

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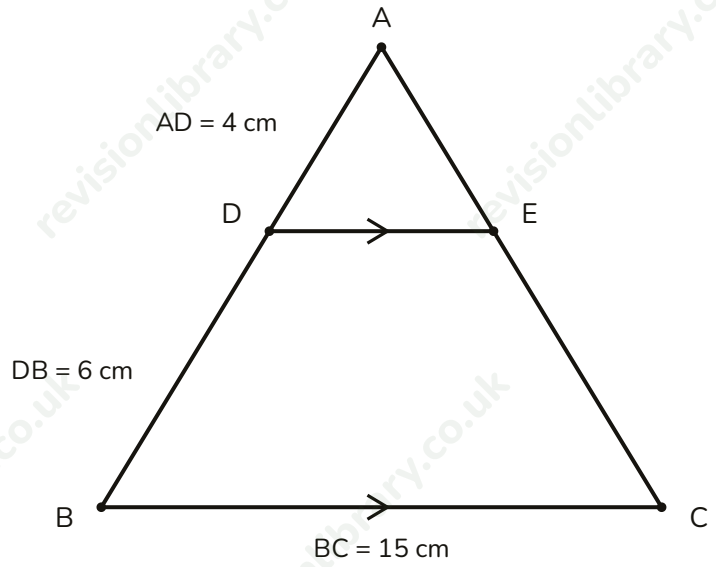
10 At the same time, a girl of height 150 cm casts a shadow 60 cm long and a tree casts a shadow 480 cm long. Work out the height of the tree, in centimetres.

(Total for Question 10 is 3 marks)

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11 In triangle ABC, D lies on AB and E lies on AC, such that DE is parallel to BC. AD = 4 cm, DB = 6 cm and BC = 15 cm. Work out the length of DE.

Diagram NOT accurately drawn

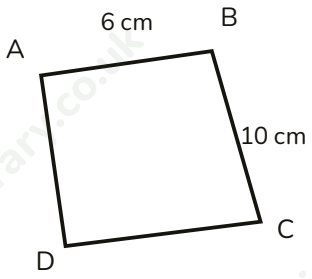


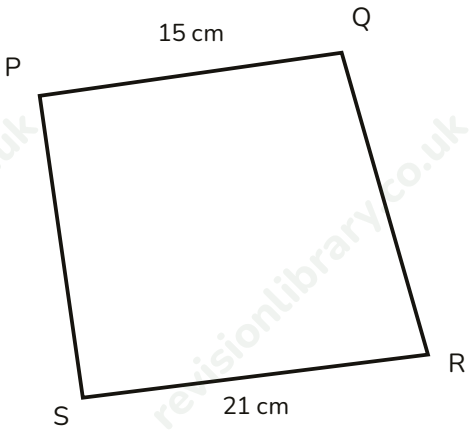
(Total for Question 11 is 4 marks)

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12 Quadrilateral ABCD is mathematically similar to quadrilateral PQRS, with AB corresponding to PQ, BC corresponding to QR, CD corresponding to RS, and DA corresponding to SP. AB = 6 cm and PQ = 15 cm.

Diagram NOT accurately drawn





(a) BC = 10 cm. Work out the length of QR. **(2)**

.....

(b) RS = 21 cm. Work out the length of CD. **(2)**

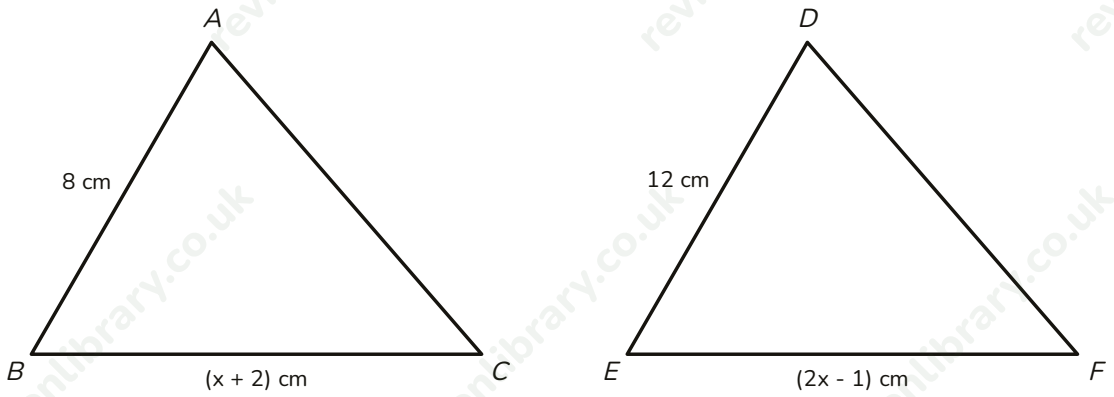
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(Total for Question 12 is 4 marks)

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13 Triangle ABC is similar to triangle DEF, with AB corresponding to DE and BC corresponding to EF. AB = 8 cm, DE = 12 cm, BC = (x + 2) cm and EF = (2x - 1) cm.

Diagram NOT accurately drawn



(a) Work out the value of x. **(3)**

(b) Hence work out the length of BC. **(2)**

(Total for Question 13 is 5 marks)

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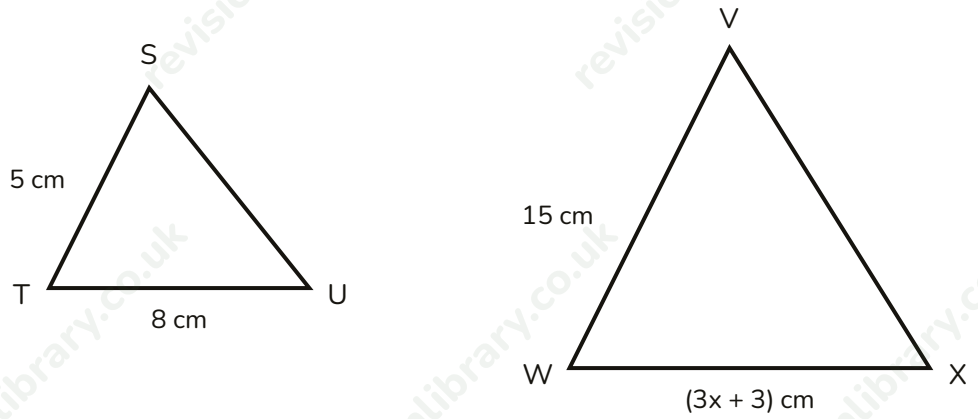
14 Shape A has sides of length 4 cm and x cm. Shape B is mathematically similar to shape A, with corresponding sides of length 10 cm and 12 cm (10 cm corresponding to the 4 cm side). Work out the value of x.

(Total for Question 14 is 3 marks)

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15 Triangle STU is similar to triangle VWX, with ST corresponding to VW and TU corresponding to WX. ST = 5 cm, VW = 15 cm, TU = 8 cm and WX = (3x + 3) cm. Work out the value of x.

Diagram NOT accurately drawn



(Total for Question 15 is 3 marks)

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16 A scale drawing of a garden has scale 1 : 200. On the drawing a path is shown as 3.6 cm long. The actual path is to be extended by a similar path using the same scale.

(a) Work out the actual length of the drawn path in metres. **(3)**

.....

(b) If the extended path on the drawing is 6.4 cm, what is the total actual length of both paths in metres? **(3)**

.....

(Total for Question 16 is 6 marks)

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17 Two similar ladders are drawn on plans. The smaller ladder on the plan is 4 cm long and represents a real ladder of 2 m. The larger ladder on the plan is 9 cm long.

(a) Find the scale factor from the plan to real life for the smaller ladder. **(2)**

.....

(b) Use this scale to find the real length of the larger ladder in metres. **(3)**

.....

(c) A third ladder is drawn on the plan at length 6 cm. Using the same scale, find its real length in metres and give the answer to 1 decimal place. **(4)**

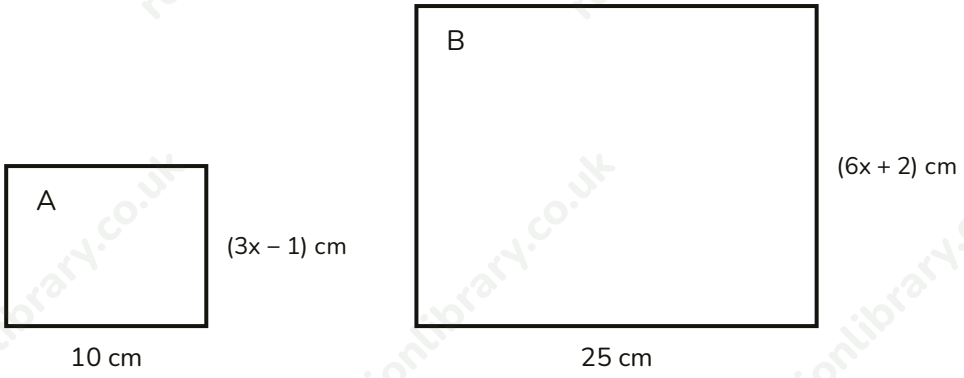
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(Total for Question 17 is 9 marks)

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18 Rectangle A has sides of length 10 cm and (3x - 1) cm. Rectangle B is mathematically similar to rectangle A. The side of rectangle B corresponding to the 10 cm side has length 25 cm. The side of rectangle B corresponding to the (3x - 1) cm side has length (6x + 2) cm.

Diagram NOT accurately drawn



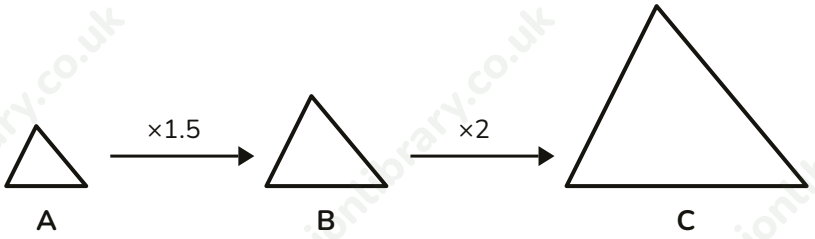
(a) Work out the value of x. **(3)**

(b) Hence work out the perimeter of rectangle A. **(2)**

(Total for Question 18 is 5 marks)

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19 Three mathematically similar triangles, A, B and C, are such that triangle B is an enlargement of triangle A with scale factor 1.5, and triangle C is an enlargement of triangle B with scale factor 2. The shortest side of triangle A is 5 cm.



(a) Work out the length of the shortest side of triangle B. **(1)**

.....

(b) Work out the length of the shortest side of triangle C. **(2)**

.....

(c) Work out the overall scale factor of enlargement from triangle A to triangle C. **(2)**

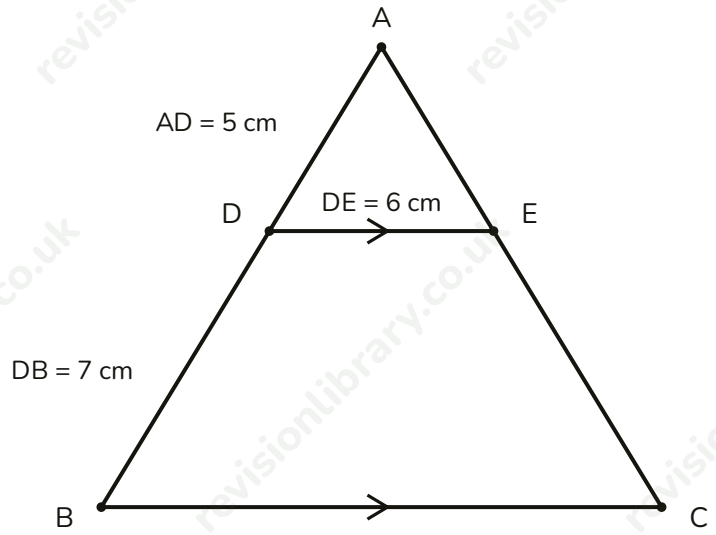
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(Total for Question 19 is 5 marks)

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20 In triangle ABC, D lies on AB and E lies on AC, such that DE is parallel to BC. AD = 5 cm, DB = 7 cm and DE = 6 cm. Work out the length of BC.

Diagram NOT accurately drawn

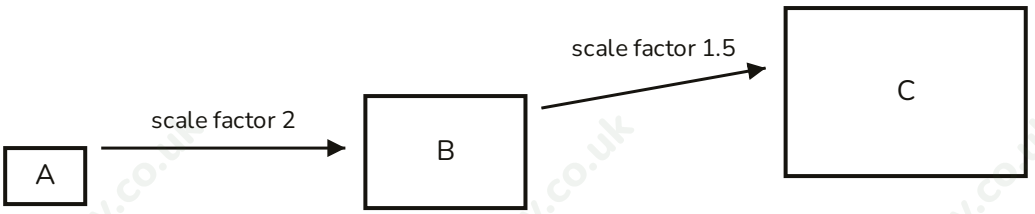


(Total for Question 20 is 4 marks)

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21 Shape A is mathematically similar to shape B, with a scale factor of enlargement from A to B of 2. Shape B is mathematically similar to shape C, with a scale factor of enlargement from B to C of 1.5. A side on shape A has length 4 cm.

Diagram NOT accurately drawn



(a) Work out the (compound) scale factor of enlargement from shape A to shape C. **(2)**

.....

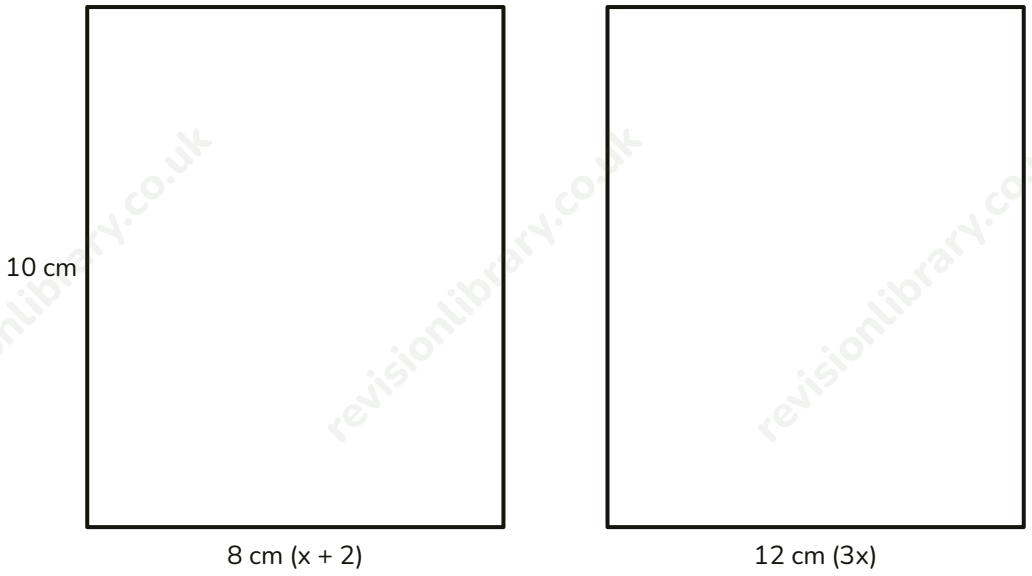
(b) Hence work out the length of the corresponding side on shape C. **(2)**

.....

(Total for Question 21 is 4 marks)

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22 Two similar rectangles have one pair of corresponding sides in the ratio (x + 2) : (3x). This pair of sides has length 8 cm in the smaller rectangle and length 12 cm in the larger rectangle (so 8 cm corresponds to x + 2 and 12 cm corresponds to 3x). The smaller rectangle's other side is 10 cm. Work out x and the larger rectangle's side corresponding to the 10 cm side.



(a) Find x. **(2)**

.....

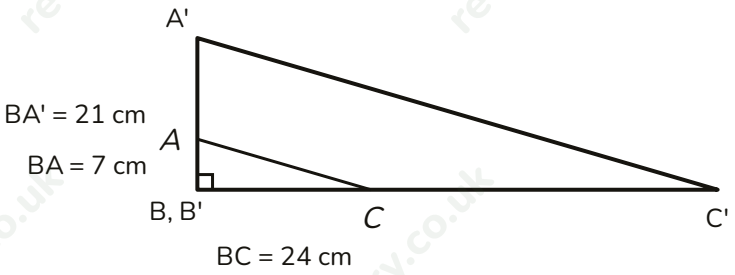
(b) Find the length in the larger rectangle that corresponds to the smaller rectangle's 10 cm side. Give your answer in cm. **(2)**

.....

(Total for Question 22 is 4 marks)

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23 A right-angled triangle ABC (right angle at B) is enlarged from triangle ABC to triangle A'B'C' with centre of enlargement at B and scale factor k. The length BA = 7 cm and BC = 24 cm. After enlargement BA' = 21 cm.



(a) Find k. **(1)**

(b) Find B'C', the image of BC, and state whether triangle A'B'C' is still right-angled at B'. Explain briefly. **(3)**

(Total for Question 23 is 4 marks)

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Mark scheme · 5.18 Similar Shapes (Lengths): 2-hour Pack

Question 1

(a) 3 cao **B1**

(a) Answer: 3

(b) 10 x their scale factor **M1**

(b) 30 (cm) cao ft their (a) **A1**

(b) Answer: 30 cm

Question 2

(a) 42 x 2.5 **M1**

(a) 105 (cm) cao **A1**

(a) Answer: 105 cm

(b) 6 x 2.5 **M1**

(b) 15 (cm) cao **A1**

(b) Answer: 15 cm

Question 3

(a) 20 x 3/5 **M1**

(a) 12 (cm) cao **A1**

(a) Answer: 12 cm

(b) 21 divide by 3/5 oe (= 21 x 5/3) **M1**

(b) 35 (cm) cao **A1**

(b) Answer: 35 cm

Question 4

(a) 9 / 3 (= 3) (value of one ratio unit found), then x 7 **M1**

(a) 21 (cm) cao **A1**

(a) Answer: 21 cm

(b) 15 x 7/3 oe (using the same scale factor as LM to PQ) **M1**

(b) 35 (cm) cao **A1**

(b) Answer: 35 cm

(c) 84 x 3/7 oe (dividing by the scale factor 7/3) **M1**

(c) 36 (cm) cao **A1**

(c) Answer: 36 cm

Question 5

39/18 or 30/18 x 39 oe **M1**

65 cm cao **A1**

Answer: 65 cm

Question 6

scale factor 4/6 = 2/3 oe **M1**

15 cm cao **A1**

Answer: 15 cm

Question 7

the triangles are similar, so uses a ratio such as 600/120 **M1**

180 x 600 / 120 oe **M1**

900 cm cao **A1**

Answer: 900 cm

Question 8

scale factor 12/6 = 2 oe **M1**

4 cm cao **A1**

Answer: 4 cm

Question 9

27/15 or 20/15 x 27 oe **M1**

36 cm cao **A1**

Answer: 36 cm

Question 10

the triangles are similar, so uses a ratio such as 480/60 **M1**

150 x 480 / 60 oe **M1**

1200 cm cao **A1**

Answer: 1200 cm

Question 11

AB = 4 + 6 (= 10) (whole side AB found) **M1**

scale factor = 4/10 oe (= 0.4 or 2/5) (triangle ADE similar to triangle ABC since DE parallel to BC, AA) **M1**

15 x their scale factor **M1**

6 (cm) cao **A1**

Answer: 6 cm

Question 12

(a) scale factor = 15/6 oe (= 2.5 or 5/2) **M1**

(a) 25 (cm) cao **A1**

(a) Answer: 25 cm

(b) 21 / 2.5 oe (dividing by the scale factor) **M1**

(b) 8.4 (cm) cao **A1**

(b) Answer: 8.4 cm

Question 13

(a) scale factor = 12/8 oe (= 1.5) **M1**

(a) 2x - 1 = 1.5(x + 2) oe (correct equation formed and expanded, e.g. 2x - 1 = 1.5x + 3) **M1**

(a) x = 8 cao **A1**

(a) Answer: x = 8

(b) substitutes their x into (x + 2) **M1**

(b) 10 (cm) cao ft their (a) **A1**

(b) Answer: 10 cm

Question 14

scale factor = 10/4 oe (= 2.5) **M1**

their 2.5 x x = 12 oe (correct equation formed) **M1**

x = 4.8 cao **A1**

Answer: x = 4.8

Question 15

scale factor = 15/5 oe (= 3) **M1**

3x + 3 = 8 x 3 oe, i.e. 3x + 3 = 24 **M1**

x = 7 cao **A1**

Answer: x = 7

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Question 16

(a) use scale 1:200 so actual length = 3.6 cm x 200 = 720 cm **M1**

(a) convert 720 cm to metres: 720/100 = 7.2 m **M1**

(a) 7.2 m cao **A1**

(a) Answer: 7.2 m

(b) find actual length of extended path: 6.4 x 200 = 1280 cm = 12.8 m **M1**

(b) add lengths: 7.2 + 12.8 = 20.0 m **M1**

(b) 20.0 m cao **A1**

(b) Answer: 20.0 m

Question 17

(a) convert 2 m to 200 cm and form ratio 4 cm : 200 cm or simplify **M1**

(a) 1 : 50 cao (or plan:real = 1:50) **A1**

(a) Answer: 1 : 50

(b) scale 1:50 so real length = 9 x 50 = 450 cm **M1**

(b) convert 450 cm to metres: 450/100 = 4.5 m **M1**

(b) 4.5 m cao **A1**

(b) Answer: 4.5 m

(c) use scale 1:50 so real length = 6 x 50 = 300 cm **M1**

(c) convert 300 cm to metres = 3.0 m **M1**

(c) 3.0 m cao **A1**

(c) answer given to 1 d.p. as 3.0 m **B1**

(c) Answer: 3.0 m (to 1 d.p.)

Question 18

(a) scale factor = 25/10 oe (= 2.5) **M1**

(a) 6x + 2 = 2.5(3x - 1) oe (correct equation formed and expanded, e.g. 6x + 2 = 7.5x - 2.5) **M1**

(a) x = 3 cao **A1**

(a) Answer: x = 3

(b) 3x - 1 = 8 (cm) found, and 2(10 + 8) oe **M1**

(b) 36 (cm) cao ft their (a) **A1**

(b) Answer: 36 cm

Question 19

(a) 7.5 (cm) cao **B1**

(a) Answer: 7.5 cm

(b) their (a) x 2 oe, or 5 x (1.5 x 2) **M1**

(b) 15 (cm) cao **A1**

(b) Answer: 15 cm

(c) 1.5 x 2 **M1**

(c) 3 cao **A1**

(c) Answer: 3

Question 20

AB = 5 + 7 (= 12) (whole side AB found) **M1**

scale factor from ADE to ABC = 12/5 oe, or from ABC to ADE = 5/12 (triangles similar since DE parallel to BC, AA) **M1**

BC = 6 / their (5/12) oe, i.e. 6 x 12/5 **M1**

14.4 (cm) cao **A1**

Answer: 14.4 cm

Question 21

(a) 2 x 1.5 oe (compound scale factor) **M1**

(a) 3 cao **A1**

(a) Answer: 3

(b) 4 x their 3 **M1**

(b) 12 (cm) cao ft their (a) **A1**

(b) Answer: 12 cm

Question 22

(a) form equation (x+2)/(3x) = 8/12 and simplify to (x+2)/(3x) = 2/3 **M1**

(a) x = 2 cao **A1**

(a) Answer: x = 2

(b) use scale factor = 3x/(x+2) with x = 2, so scale factor = 6/4 = 3/2 (consistent with 12/8 = 3/2) and apply to 10 **M1**

(b) 15 cm cao **A1**

(b) Answer: 15 cm

Question 23

(a) k = BA'/BA = 21/7 = 3 **B1**

(a) Answer: k = 3

(b) use B'C' = k x BC = 3 x 24 **M1**

(b) 72 cm cao for B'C' **A1**

(b) explain: enlargement from B preserves the angle at B so triangle A'B'C' is right-angled at B' oe **B1**

(b) Answer: B'C' = 72 cm; triangle A'B'C' is still right-angled at B' because an enlargement with centre at B preserves the angle at B (same rays), so the right angle is preserved.

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