HIGHER

3.11H Scale Drawings: Higher Tier Practice

EDEXCEL Edexcel 1MA1 · Calculator allowed · about 75 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 A plan of a classroom is drawn at a scale of 1:50. The length of the classroom on the plan is 8.2 cm.
Work out the actual length of the classroom in metres.

(Total for Question 1 is 1 mark)

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2 A map uses a scale of 1:250 000 (1 cm represents 2.5 km). Two villages A and B are 3.6 cm apart on the map.
(a) Work out the actual distance between A and B in kilometres.
(b) A cyclist travels from A to B at an average speed of 18 km/h. Work out the time taken in hours and minutes to two significant figures.

(a) Work out the actual distance between A and B in kilometres. **(1)**

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(b) Work out the time taken in hours and minutes (to two significant figures). **(1)**

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(Total for Question 2 is 2 marks)

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3 A rectangular garden is drawn on a plan with scale 1:200. On the plan the garden measures 6.4 cm by 3.0 cm.
Work out the actual area of the garden in square metres. Give your answer to 3 significant figures.

(Total for Question 3 is 3 marks)

4 A model car is similar to the real car. The scale factor of similarity (model : real) for linear dimensions is 1:18.
(a) Work out the area scale factor (model : real).
(b) The model has a painted roof area of 12 cm^2. Work out the area of the real car roof in square metres. Give your answer in standard form to 2 significant figures.

(a) Work out the area scale factor (model : real). **(1)**

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(b) The model roof area is 12 cm^2. Work out the real roof area in m^2, give answer in standard form to 2 s.f. **(2)**

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(Total for Question 4 is 3 marks)

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5 A house is shown on a plan drawn at scale 1:1250. The width of the front of the house on the plan is 2.4 cm.
Work out the actual width of the front of the house in metres. Give your answer to the nearest 0.1 m.

(Total for Question 5 is 2 marks)

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6 A scaled drawing of a rectangular swimming pool has length 5x cm and width 3x cm on the plan. The scale is 1:100 for linear measurements. The actual pool has an area of 450 m^2.
Show that x satisfies the equation $x^2 = 30$. Hence find the value of x to 2 decimal places.

(Total for Question 6 is 4 marks)

7 An architect draws a rectangular plot on a site plan at scale 1:400. On the drawing the diagonal of the rectangle measures 18.2 cm. The actual rectangle has the property that its length is twice its width. Work out the actual dimensions of the rectangle in metres. Give your answers to 3 significant figures where appropriate.

(a) Find the actual length of the diagonal in metres. **(2)**

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(b) Let width = w and length = 2w. Using the diagonal found in part (a), form an equation and solve to find w. Give the width and length to 3 significant figures. **(6)**

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(Total for Question 7 is 8 marks)

8 A surveyor produces a scale drawing of a triangular field. On the drawing the sides are 7.2 cm, 5.4 cm and 4.2 cm. The scale is 1:500 for linear measurements.
(a) Work out the actual perimeter of the field in metres to 3 significant figures.
(b) Hence, or otherwise, find the actual area of the field in square metres. Give your answer to 3 significant figures. (You may use Heron's formula.)

(a) Work out the actual perimeter of the field in metres to 3 significant figures. **(3)**

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(b) Hence, or otherwise, find the actual area of the field in square metres. Give your answer to 3 significant figures. **(6)**

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(Total for Question 8 is 9 marks)

9 A designer creates a scale elevation of a triangular sail on a boat. On the drawing the base is 24.0 cm and the height (from base to apex perpendicular) is 18.0 cm. The actual sail must have an area of 27.0 m^2.

Find the linear scale factor (drawing : actual) and hence find the actual base and actual perpendicular height of the sail in metres. Give answers to 3 significant figures.

(a) Find the area of the sail on the drawing in cm^2. **(2)**

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(b) Find the linear scale factor k (drawing : actual) and hence find the actual base and height in metres. Give all answers to 3 significant figures. **(7)**

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(Total for Question 9 is 9 marks)

10 A planning officer examines a new development drawn at scale 1:1250. A circular recreational area appears on the plan with radius 2.88 cm. The developer plans to make the actual area a grassed circular area with a perimeter path of constant width 4.32 m around the grass (path lies outside the grass circle and is included in the overall circular area). The total area including the path must be 5000 m^2.

(a) Work out the actual radius of the grassed circle in metres.

(b) Hence calculate the width of the path required (in metres) so that the total overall area including the path is 5000 m^2. Give your answer to 2 decimal places.

(a) Work out the actual radius of the grassed circle in metres. **(3)**

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(b) Hence calculate the width of the path required (in metres) so that the total overall area including the path is 5000 m^2. Give your answer to 2 decimal places. **(6)**

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(Total for Question 10 is 9 marks)

Mark scheme · 3.11H Scale Drawings: Higher Tier Practice

Question 1

- **B1** 4.10 m cao
- **Answer: 4.10 m**

Question 2

- (a) **B1** 9.0 km cao
- **(a) Answer: 9.0 km**
- (b) **B1** 30 minutes cao
- **(b) Answer: 30 minutes**

Question 3

- **M1** convert plan lengths to actual: 6.4 cm -> 12.8 m and 3.0 cm -> 6.0 m (scale 1:200)
- **M1** calculate area 12.8 * 6.0
- **A1** 76.8 m^2 awrt 76.8 to 3 s.f. cao
- **Answer: 76.8 m^2**

Question 4

- (a) **B1** 1 : 324 cao
- **(a) Answer: 1 : 324**
- (b) **M1** scale up area by factor 324: real area = 12 * 324 = 3888 cm^2
- (b) **A1** 3.9 x 10^{-1} m^2 cao (3888 cm^2 = 0.3888 m^2 -> 3.9 x 10^{-1} to 2 s.f.)
- **(b) Answer: 3.9 x 10^{-1} m^2**

Question 5

- **M1** convert 2.4 cm at 1:1250 -> actual length = 2.4 * 1250 cm = 3000 cm
- **A1** 30.0 m cao (3000 cm = 30.0 m) to nearest 0.1 m
- **Answer: 30.0 m**

Question 6

- **M1** convert plan lengths to actual using the scale 1:100 (1 cm on plan = 1 m actual): length = 5x m and width = 3x m, then form area = 5x * 3x
- **M1** simplify area equation: 15 x^2 = 450 leading to x^2 = 450 / 15
- **A1** x^2 = 30 cao
- **A1** x = 5.48 to 2 d.p. cao
- **Answer: x = 5.48**

Question 7

- (a) **M1** convert 18.2 cm at 1:400 -> actual diagonal = 18.2 * 400 cm = 7280 cm = 72.8 m
- (a) **A1** 72.8 m cao
- **(a) Answer: 72.8 m**
- (b) **M1** form equation using Pythagoras: $w^2 + (2w)^2 = 72.8^2$
- (b) **M1** simplify to $5w^2 = 72.8^2$ and rearrange to $w^2 = 72.8^2 / 5$
- (b) **M1** take square root to find $w = \sqrt{72.8^2 / 5}$
- (b) **A1** w = 32.56... m awrt 32.6 m to 3 s.f.
- (b) **M1** find length = 2w = 65.12... m
- (b) **A1** length = 65.1 m to 3 s.f.
- **(b) Answer: width = 32.6 m, length = 65.1 m**

Question 8

- (a) **M1** convert each side by factor 500: 7.2*500 = 3600 cm, 5.4*500 = 2700 cm, 4.2*500 = 2100 cm
- (a) **M1** sum perimeter in cm = 3600 + 2700 + 2100 = 8400 cm = 84.00 m
- (a) **A1** 84.0 m cao to 3 s.f.
- **(a) Answer: 84.0 m**
- (b) **M1** convert sides to metres: 36.00 m, 27.00 m, 21.00 m
- (b) **M1** use Heron: s = (36 + 27 + 21)/2 = 42.0 m
- (b) **M1** compute area = $\sqrt{s(s-a)(s-b)(s-c)}$ method
- (b) **M1** numerical substitution: area = $\sqrt{42*(42-36)*(42-27)*(42-21)}$ = $\sqrt{42*6*15*21}$
- (b) **A1** area = 281.7... m^2 awrt 282 m^2 to 3 s.f.
- (b) **A1** final area 282 m^2 cao
- **(b) Answer: 282 m^2**

Question 9

- (a) **M1** area drawing = 1/2 * base * height = 0.5 * 24.0 * 18.0
- (a) **A1** 216 cm^2 cao
- **(a) Answer: 216 cm^2**
- (b) **M1** use area scale relation: area_drawing / area_actual = k^2 where k is linear scale (drawing : actual). Here 216 cm^2 / 27.0 m^2
- (b) **M1** convert 27.0 m^2 to cm^2: 27.0 * 10000 = 270000 cm^2 and form k^2 = 216 / 270000
- (b) **M1** compute k^2 = 0.0008 and take square root k = $\sqrt{0.0008}$
- (b) **M1** numerical evaluation to find k = 0.028284271... (showing correct method)
- (b) **A1** k = 0.0283 to 3 s.f.
- (b) **M1** scale up drawing lengths by 1/k to get actual: actual base = 24.0 / k cm -> convert to metres
- (b) **A1** actual base = 8.49 m to 3 s.f. and actual height = 6.36 m to 3 s.f.
- **(b) Answer: k = 0.0283, actual base = 8.49 m, actual height = 6.36 m**

Question 10

- (a) **M1** convert 2.88 cm at 1:1250 -> actual radius = 2.88 * 1250 cm = 3600 cm
- (a) **M1** convert to metres: 3600 cm = 36.00 m
- (a) **A1** 36.00 m cao
- **(a) Answer: 36.00 m**
- (b) **M1** use A_total = π * R_total^2 where R_total = r + w and A_total = 5000, r = 36.00
- (b) **M1** set up equation: π * $(36 + w)^2$ = 5000
- (b) **M1** rearrange: $(36 + w)^2$ = 5000 / π and take square root to get 36 + w = $\sqrt{5000 / \&\pi;}$
- (b) **M1** numerical evaluation: $\sqrt{5000 / \&\pi;}$ = 39.89... (show method)
- (b) **A1** 36 + w = 39.89... -> w = 3.89... m
- (b) **A1** w = 3.89 m to 2 d.p. cao
- **(b) Answer: 3.89 m**