

Name: .....

Date: .....

**INSTRUCTIONS TO CANDIDATES**

1. Answer **all** the questions.
2. Calculators may **not** be used.
3. All working must be clearly shown. Omission of essential working will result in loss of marks.
4. The marks for each question is shown in brackets [ ] at the end of each question.

- 
- 1 A model of a racing bicycle is made to a scale of  $\frac{1}{20}$ .
- (a) Calculate the length of the handle bar on the model, in centimetres, if the actual length of the handle bar is 0.6 m.
  - (b) The area of the front wheel of the model is  $12 \text{ cm}^2$ . Calculate the actual area of the front wheel of the bicycle, giving your answer in square metres.

Answer (a) ..... cm [1]

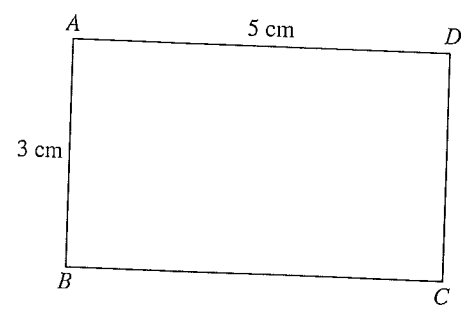
(b) .....  $\text{m}^2$  [2]

- 2 A plan of a shop is drawn to a scale of 1 : 200.
- (a) Find the width, in metres of the shop which is represented by a line 3.5 cm long on the plan.
  - (b) The area of the shop space is  $54 \text{ m}^2$ . Find, in square centimetres, the area on the plan which represents this shop space.

Answer (a) ..... m [1]

(b) .....  $\text{cm}^2$  [2]

- 3
- (a) A bridge 2.5 km long is represented by a line of 4 cm on a map. Find the R. F. of the map.
  - (b) A map is drawn to a scale of 1 : 50 000. Find, in square kilometres, the actual area of a wildlife sanctuary measuring  $20 \text{ cm}^2$  on the map.
  - (c) A rectangular plot of land  $ABCD$  is drawn to a scale of 1 : 200 as shown below. Calculate, in square metres, the actual area of the plot of land.



Answer (a) R. F. = ..... [1]

(b) .....  $\text{km}^2$  [2]

(c) .....  $\text{m}^2$  [3]

- 4 A map is drawn to a scale of 5 cm to 1 km.
- (a) Two island resorts are located 2.5 km apart. Calculate, in centimetres, their distance apart on the map.
  - (b) On the map, a lagoon has an area of  $20 \text{ cm}^2$ . Calculate, in square kilometres, the actual area of the lagoon.

Answer (a) ..... cm [1]

(b) .....  $\text{km}^2$  [2]

- 
- 5 A map is drawn to a scale of 1 : 50 000.
- (a) The distance between two cities on a map is 165 cm. Calculate the actual distance between these two cities, giving your answer in kilometres.
  - (b) The actual area of a park is  $2.8 \text{ km}^2$ . Calculate the area on the map which represents the park, giving your answer in square centimetres.

Answer (a) ..... km [1]

(b) .....  $\text{cm}^2$  [2]

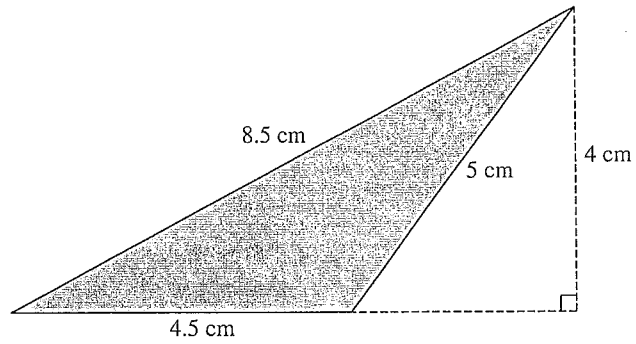
- 6 (a) A model of a tanker is made. The length of the model is 3.5 cm and the length of the actual tanker is 14 m. Express the scale of the model in the form 1 :  $n$ .
- (b) An area of 225 cm<sup>2</sup> on a map represents the area of a forest reserve of 36 km<sup>2</sup>. Find the R. F. of the map.
- (c) The plan of a theatre is drawn to a scale of 1 : 50. Find, in square metres, the actual area of the rectangular stage measuring 24 cm by 15 cm on the plan.

Answer (a) ..... [1]

(b) R. F. = ..... [2]

(c) ..... m<sup>2</sup> [2]

- 7 1 cm on a map represents an actual distance of 300 m. A triangular plot of land is represented by the triangle shown below.
- (a) Find the actual perimeter, in metres, of the plot of land.
- (b) Calculate the actual area of the plot of land in hectares. (Given 1 hectare = 10 000 m<sup>2</sup>.)



Answer (a) ..... m [2]

(b) ..... ha [2]

C.E.M. - Tukson  
 Tel: 9666-3331  
 Suite 201/174 Sardener Rd  
 ROSEBERG NSW 2018

- 8 A map is drawn to a scale of 1 : 400 000.
- (a) Find the distance, in kilometres, between two villages which are represented on the map by points 6.5 cm apart.
  - (b) An island covers an area of 640 km<sup>2</sup>. Find, in square centimetres, the area representing the island on the map.

Answer (a) ..... km [1]

(b) ..... cm<sup>2</sup> [2]

- 
- 9 Given that 5 cm on a map represents 6 km on the ground,
- (a) calculate the distance, in kilometres, between two bus stops which are represented by a line of length  $1\frac{1}{2}$  cm on the map,
  - (b) express the scale of the map in the form 1 :  $n$ ,
  - (c) calculate, in square centimetres, the area on the map which represents an actual vineyard which measures 54 km<sup>2</sup>.

Answer (a) ..... km [1]

(b) ..... [1]

(c) ..... cm<sup>2</sup> [2]

10. A draftsman drew the floor plan of a library using a scale of 1 : 150.
- (a) Find the length, in metres, of a wall in the library represented by a line of 6 cm on the plan.
  - (b) The children's reading corner in the library covers an area of  $18 \text{ m}^2$ . Find, in square centimetres, the area representing the reading corner on the plan.
  - (c) The reference section in the library is represented on the plan by an area of  $36 \text{ cm}^2$ . Find, in square centimetres, the area representing this section on a second plan whose scale is 1 : 50.

Answer (a) ..... m [1]

(b) .....  $\text{cm}^2$  [2]

(c) .....  $\text{cm}^2$  [3]

(b) (i) Since  $\triangle ABC$  is similar to  $\triangle ADE$ ,

$$\frac{AB}{AD} = \frac{BC}{DE}$$

$$\frac{AB}{10} = \frac{5}{8}$$

$$AB = \frac{5}{8} \times 10$$

$$= 6\frac{1}{4} \text{ cm}$$

$$BD = AD - AB$$

$$= 10 - 6\frac{1}{4}$$

$$= 3\frac{3}{4} \text{ cm}$$

(ii)  $\triangle DBC$  is similar to  $\triangle DAF$ .

$$\therefore \frac{AF}{BC} = \frac{DA}{DB}$$

$$\frac{AF}{5} = \frac{10}{3\frac{3}{4}}$$

$$AF = \frac{10}{3\frac{3}{4}} \times 5$$

$$= 13\frac{1}{3} \text{ cm}$$

(c)  $\triangle CDE$  is similar to  $\triangle CFA$ .

$$\therefore \frac{DC}{CF} = \frac{DE}{AF}$$

$$\frac{DC}{CF} = \frac{8}{13\frac{1}{3}}$$

$$= 8 \times \frac{3}{40}$$

$$= \frac{3}{5}$$

#### Test 4: Scales and Maps

1. (a) 1 cm represents 20 cm  
or 0.2 m.

$\therefore$  0.6 m is represented by

$$\frac{0.6}{0.2} \text{ cm} = 3 \text{ cm.}$$

The length of the handle bar on the model is 3 cm.

$$100 \text{ cm} = 1 \text{ m}$$

$$20 \text{ cm} = \frac{20}{100} \text{ m}$$

$$= 0.2 \text{ m}$$



#### Teacher's Tip

A scale of  $\frac{1}{20}$  means a length of 1 cm on the model represents an actual length of 20 cm.

(b) 1 cm represents 0.2 m.

$$\therefore 1 \text{ cm}^2 \text{ represents } (0.2 \text{ m})^2 = 0.04 \text{ m}^2.$$

$$\therefore 12 \text{ cm}^2 \text{ represents } 12 \times 0.04 = 0.48 \text{ m}^2.$$

The actual area of the front wheel is 0.48 m<sup>2</sup>.



#### Teacher's Tip

The area scale of a map is the square of its linear scale. If the linear scale is 1 :  $n$ , then the area scale is  $(1)^2 : (n)^2 = 1 : n^2$ .

2. (a) 1 cm represents 200 cm or 2 m.

$$\therefore 3.5 \text{ cm represents } 3.5 \times 2 = 7 \text{ m.}$$

The width of the shop is 7 m.

(b) 2 m is represented by 1 cm.

1 m is represented by  $\frac{1}{2}$  cm.

$$\therefore 1 \text{ m}^2 \text{ is represented by } \left(\frac{1}{2} \text{ cm}\right)^2 = \frac{1}{4} \text{ cm}^2.$$

$$\therefore 54 \text{ m}^2 \text{ is represented by } 54 \times \frac{1}{4} = 13.5 \text{ cm}^2.$$

The area of the plan representing the shop space is 13.5 cm<sup>2</sup>.

3. (a) 4 cm : 2.5 km

$$1 \text{ km} = 100\,000 \text{ cm}$$

$$= 4 \text{ cm} : 250\,000 \text{ cm}$$

$$= 1 : 62\,500$$

Divide the ratio by 4.

$$\therefore \text{the R.F. of the map is } \frac{1}{62\,500}.$$



#### Teacher's Tip

The representative fraction (R.F.) expresses the linear scale of a map 1 :  $n$  in the form  $\frac{1}{n}$ .

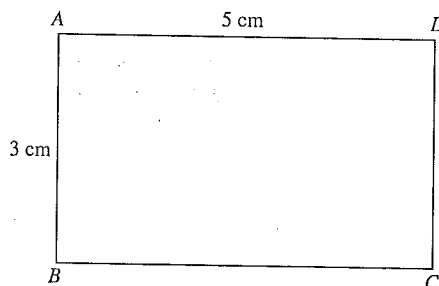
(b) 1 cm represents 50 000 cm or  $\frac{1}{2}$  km.

$$\therefore 1 \text{ cm}^2 \text{ represents } \left(\frac{1}{2} \text{ km}\right)^2 = \frac{1}{4} \text{ km}^2.$$

$$\therefore 20 \text{ cm}^2 \text{ represents } 20 \times \frac{1}{4} = 5 \text{ km}^2.$$

The actual area of the wildlife sanctuary is 5 km<sup>2</sup>.

(c)



$$\text{Area of rectangle } ABCD = 5 \times 3 = 15 \text{ cm}^2$$

1 cm represents 200 cm or 2 m.

$$\therefore 1 \text{ cm}^2 \text{ represents } (2 \text{ m})^2 = 4 \text{ m}^2.$$

$$\therefore 15 \text{ cm}^2 \text{ represents } 15 \times 4 = 60 \text{ m}^2.$$

The actual area of the rectangular plot of land is 60 m<sup>2</sup>.



4. (a) 1 km is represented by 5 cm.  
 $\therefore$  2.5 km is represented by  $2.5 \times 5 = 12.5$  cm.  
 Their distance apart on the map is **12.5 cm**.

(b) 5 cm represents 1 km.

1 cm represents  $\frac{1}{5}$  km.

$\therefore$  1 cm<sup>2</sup> represents  $\left(\frac{1}{5} \text{ km}\right)^2 = \frac{1}{25} \text{ km}^2$ .

$\therefore$  20 cm<sup>2</sup> represents  $20 \times \frac{1}{25} = \frac{4}{5} = 0.8 \text{ km}^2$ .

The actual area of the lagoon is **0.8 km<sup>2</sup>**.

5. (a) 1 cm represents 50 000 cm or  $\frac{1}{2}$  km.

$\therefore$  165 cm represents  $165 \times \frac{1}{2} = 82\frac{1}{2}$  km.

The actual distance between the cities is  **$82\frac{1}{2}$  km**.

- (b)  $\frac{1}{2}$  km is represented by 1 cm.

1 km is represented by 2 cm.

$\therefore$  1 km<sup>2</sup> is represented by  $(2 \text{ cm})^2 = 4 \text{ cm}^2$ .

$\therefore$  2.8 km<sup>2</sup> is represented by  $2.8 \times 4 = 11.2 \text{ cm}^2$ .

The area of the park on the map is **11.2 cm<sup>2</sup>**.

6. (a) 3.5 cm : 14 m

= 3.5 cm : 1400 cm

= 1 cm :  $\frac{1400}{3.5}$  cm

= 1 : 400

$\therefore$  the scale of the model is **1 : 400**.

$$\begin{aligned} 1 \text{ m} &= 100 \text{ cm} \\ 14 \text{ m} &= 14 \times 100 \\ &= 1400 \text{ cm} \end{aligned}$$

- (b) 225 cm<sup>2</sup> represents 36 km<sup>2</sup>.

$(15 \text{ cm})^2$  represents  $(6 \text{ km})^2$ .

$\therefore$  15 cm represents 6 km.

1 cm represents  $\frac{600\,000 \text{ cm}}{15} = 40\,000 \text{ cm}$ .

$\therefore$  the R.F of the map is  $\frac{1}{40\,000}$ .

- (c) Area of rectangular stage on the plan

=  $24 \times 15$

= 360 cm<sup>2</sup>

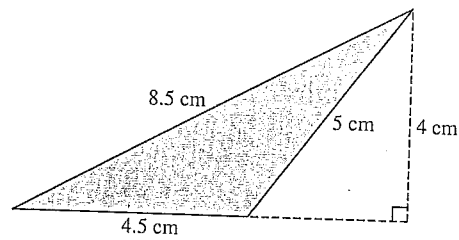
1 cm represents 50 cm or  $\frac{1}{2}$  m.

$\therefore$  1 cm<sup>2</sup> represents  $\left(\frac{1}{2} \text{ m}\right)^2 = \frac{1}{4} \text{ m}^2$ .

$\therefore$  360 cm<sup>2</sup> represents  $360 \times \frac{1}{4} = 90 \text{ m}^2$ .

The actual area of the stage is **90 m<sup>2</sup>**.

7. (a)



Perimeter of the plot of land on the map .

=  $4.5 + 5 + 8.5$

= 18 cm

1 cm represents 300 m.

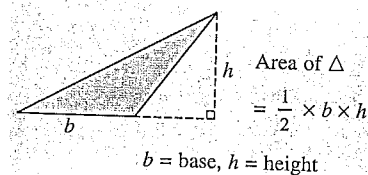
$\therefore$  18 cm represents  $18 \times 300 = 5400$  m.

The actual perimeter of the plot of land is **5400 m**.

- (b) Area of the plot of land on the map

=  $\frac{1}{2} \times 4.5 \times 4$

= 9 cm<sup>2</sup>



$b = \text{base}, h = \text{height}$

1 cm represents 300 m.

$\therefore$  1 cm<sup>2</sup> represents  $(300 \text{ m})^2 = 90\,000 \text{ m}^2$ .

$\therefore$  9 cm<sup>2</sup> represents  $9 \times 90\,000 = 810\,000 \text{ m}^2$ .

$810\,000 \text{ m}^2 = \frac{810\,000}{10\,000} \text{ ha}$      1 ha = 10 000 m<sup>2</sup>

= 81 ha

The actual area of the plot of land is **81 ha**.

8. (a) 1 cm represents 400 000 cm

1 km = 100 000 cm

or 4 km.

$\therefore$  6.5 cm represents  $6.5 \times 4 = 26$  km.

The distance between the two villages is **26 km**.

- (b) 4 km is represented by 1 cm.

1 km is represented by  $\frac{1}{4}$  cm.

$\therefore$  1 km<sup>2</sup> is represented by  $\left(\frac{1}{4} \text{ cm}\right)^2 = \frac{1}{16} \text{ cm}^2$ .

$\therefore$  640 km<sup>2</sup> is represented by  $640 \times \frac{1}{16} = 40 \text{ cm}^2$ .

The area of the island on the map is **40 cm<sup>2</sup>**.

9. (a) 5 cm represents 6 km.

1 cm represents  $\frac{6}{5}$  km or 1.2 km.

$\therefore$   $1\frac{1}{2}$  cm represents  $1.5 \times 1.2 = 1.8$  km.

The distance between the two bus stops is **1.8 km**.

(b)  $1 \text{ cm} : 1.2 \text{ km}$   
 $= 1 \text{ cm} : 120\,000 \text{ cm}$   
 $\therefore$  the scale of the map is  $1 : 120\,000$ .

(c)  $\frac{6}{5} \text{ km}$  is represented by  $1 \text{ cm}$ .  
 $1 \text{ km}$  is represented by  $\frac{5}{6} \text{ cm}$ .  
 $\therefore 1 \text{ km}^2$  is represented by  $\left(\frac{5}{6} \text{ cm}\right)^2 = \frac{25}{36} \text{ cm}^2$ .  
 $\therefore 54 \text{ km}^2$  is represented by  $54 \times \frac{25}{36} = 37\frac{1}{2} \text{ cm}^2$ .  
The area on the map representing the vineyard is  $37\frac{1}{2} \text{ cm}^2$ .

10. (a)  $1 \text{ cm}$  represents  $150 \text{ cm}$  or  $1.5 \text{ m}$ .  
 $\therefore 6 \text{ cm}$  represents  $6 \times 1.5 = 9 \text{ m}$ .  
The length of the wall of the library is  $9 \text{ m}$ .

(b)  $\frac{3}{2} \text{ m}$  is represented by  $1 \text{ cm}$ .  
 $1 \text{ m}$  is represented by  $\frac{2}{3} \text{ cm}$ .  
 $\therefore 1 \text{ m}^2$  is represented by  $\left(\frac{2}{3} \text{ cm}\right)^2 = \frac{4}{9} \text{ cm}^2$ .  
 $\therefore 18 \text{ m}^2$  is represented by  $18 \times \frac{4}{9} = 8 \text{ cm}^2$ .  
The area representing the reading corner on the plan is  $8 \text{ cm}^2$ .

(c)  $1 \text{ cm}$  represents  $\frac{3}{2} \text{ m}$ . 1st plan  
 $\therefore 1 \text{ cm}^2$  represents  $\left(\frac{3}{2} \text{ m}\right)^2 = \frac{9}{4} \text{ m}^2$ .  
 $\therefore 36 \text{ cm}^2$  represents  $36 \times \frac{9}{4} = 81 \text{ m}^2$ .  
The actual area of the reference section of the library is  $81 \text{ m}^2$ .

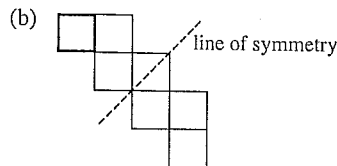
$50 \text{ cm}$  or  $\frac{1}{2} \text{ m}$  is represented by  $1 \text{ cm}$ . 2nd plan  
 $1 \text{ m}$  is represented by  $2 \text{ cm}$ .  
 $\therefore 1 \text{ m}^2$  is represented by  $(2 \text{ cm})^2 = 4 \text{ cm}^2$ .  
 $\therefore 81 \text{ m}^2$  is represented by  $81 \times 4 = 324 \text{ cm}^2$ .  
The area representing the reference section of the library on the second plan is  $324 \text{ cm}^2$ .

**Alternative method:**

$\frac{150 \text{ cm}}{50 \text{ cm}} = 3$   
 $\therefore$  the scale of the first plan to the second plan is  $1 : 3$ .  
 $1 \text{ cm}$  represents  $3 \text{ cm}$ .  
 $1 \text{ cm}^2$  represents  $(3 \text{ cm})^2 = 9 \text{ cm}^2$ .  
 $\therefore 36 \text{ cm}^2$  represents  $36 \times 9 = 324 \text{ cm}^2$ .  
The area representing the reference section of the library on the second plan is  $324 \text{ cm}^2$ .

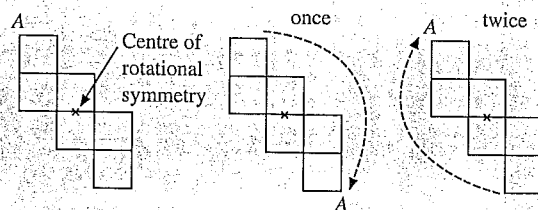
**Test 5: Symmetry**

1. (a) Order of rotational symmetry = 2



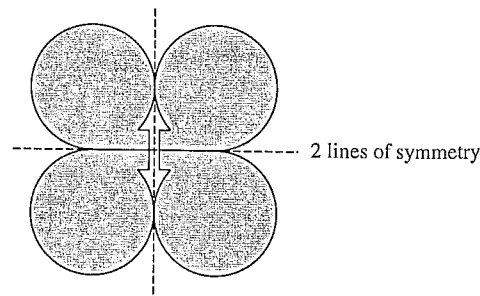
**Teacher's Tip**

- Line symmetry** — A figure has line symmetry if it can be folded on a line so that one half would fit exactly on top of the other half.
- Rotational symmetry** — A figure has rotational symmetry if the shape can be rotated less than  $360^\circ$  about a point so that it matches the original figure. The point of rotation is called the **centre of rotational symmetry**.
- Order of rotational symmetry** — The number of ways a figure can map onto itself by rotation until it gets back to its original position.



The diagram shows that the figure has rotational symmetry of order 2.

2. (a) (i) No. of lines of symmetry = 0  
(ii) Order of rotational symmetry = 8  
(b) (i) No. of lines of symmetry = 2



(ii) Order of rotational symmetry = 2

3. (a) 

p	b	o	d	q
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or  

b	p	o	q	d
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Tel: 9966 3331  
 Suite 201/414 Gardeners Rd  
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