

STD 1: Measurement (Std 1)
M5 Scale Drawings (Y12)

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Exam Equivalent Time: 46.5 minutes (based on HSC allocation of 1.5 minutes approx. per mark)



IMPORTANT FEATURES AND TIPS FROM 2UG EXAM HISTORY

- *MS-M5 Scale Drawings* is a Year 12 Standard 1 topic.
- It is comprised of content which can be found in *MS-M7 Rates and Ratios*, a Standard 2 topic, covering ratios, similarity and the associated use of scale in buildings and maps.

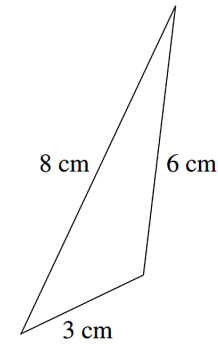
ANALYSIS - What to Expect and Common pitfalls

- *Scale Drawings* have typically been examined through house plans and maps, with mixed results.
- *Scale Drawings* were tested in 3 consecutive years between 2010-2012 in questions worth 2-3 marks. Since then, only 2015 Q29c has touched on this area and it was badly answered.
- Sample exam questions released by NESAs suggest that pure ratio questions may become more common, and this is reflected in database.

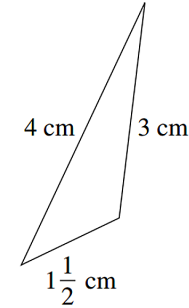
Questions

1. Measurement, 2UG 2007 HSC 4 MC

What scale factor has been used to transform Triangle *A* to Triangle *B*?



Triangle *A*



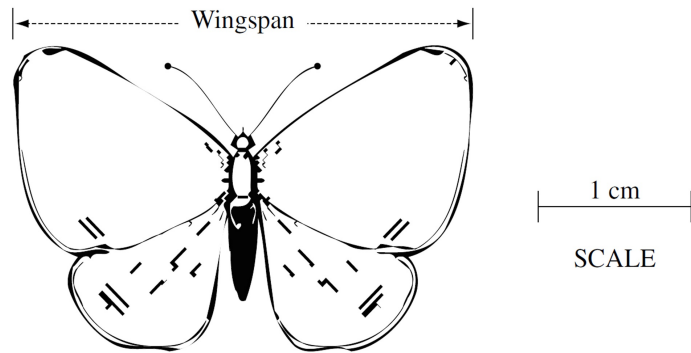
Triangle *B*

NOT
TO
SCALE

- (A) $\frac{1}{2}$
 - (B) $\frac{3}{4}$
 - (C) 2
 - (D) 3
-

2. Measurement, 2UG 2005 HSC 4 MC

The diagram is a scale drawing of a butterfly.



What is the actual wingspan of the butterfly?

- (A) 2.5 cm
- (B) 3 cm
- (C) 15 cm
- (D) 8.75 cm

3. Measurement, STD2 M7 SM-Bank 03 MC

There are 8 male chimpanzees in a community of 24 chimpanzees.

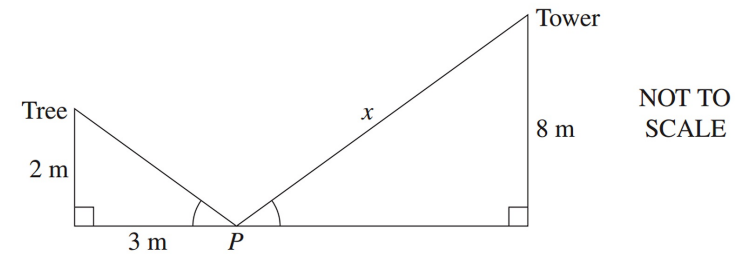
What is the ratio of males to females in the community?

- A. 1 : 3
- B. 1 : 2
- C. 3 : 1
- D. 2 : 1

4. Measurement, 2UG 2008 HSC 20 MC

A point P lies between a tree, 2 metres high, and a tower, 8 metres high. P is 3 metres away from the base of the tree.

From P , the angles of elevation to the top of the tree and to the top of the tower are equal.

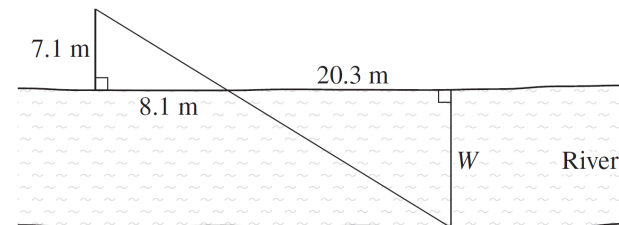


What is the distance, x , from P to the top of the tower?

- (A) 9 m
- (B) 9.61 m
- (C) 12.04 m
- (D) 14.42 m

5. Measurement, 2UG 2016 HSC 16 MC

The width (W) of a river can be calculated using two similar triangles, as shown in the diagram.

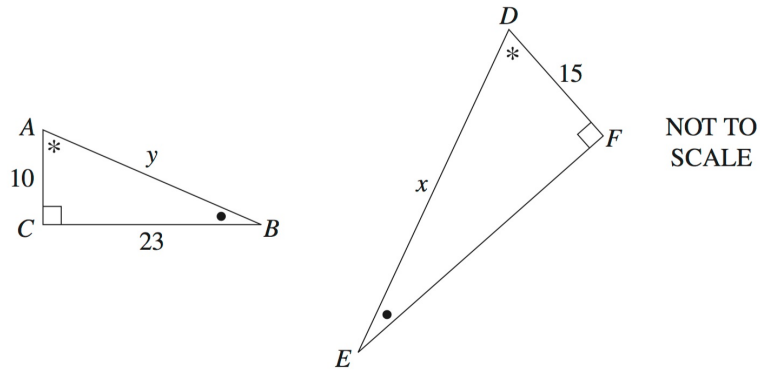


What is the approximate width of the river?

- (A) 17.8 m
- (B) 19.3 m
- (C) 23.2 m
- (D) 24.9 m

6. Measurement, 2UG 2013 HSC 17 MC

Triangles ABC and DEF are similar.



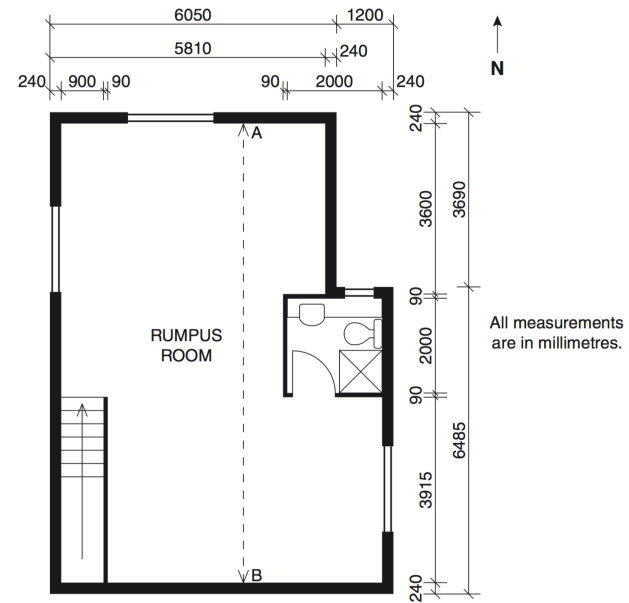
Which expression could be used to find the value of x ?

- (A) $y \times \frac{10}{15}$
- (B) $y \times \frac{10}{23}$
- (C) $y \times \frac{15}{10}$
- (D) $y \times \frac{23}{15}$

7. Measurement, 2UG 2011 HSC 24a

- ▲ Part i: RAP Data - Bottom 3%: School result (72%) was -3% below state average (75%)
- ⚡ Part ii: RAP Data - Bottom 10%: School result (68%) was 1% above state average (67%)

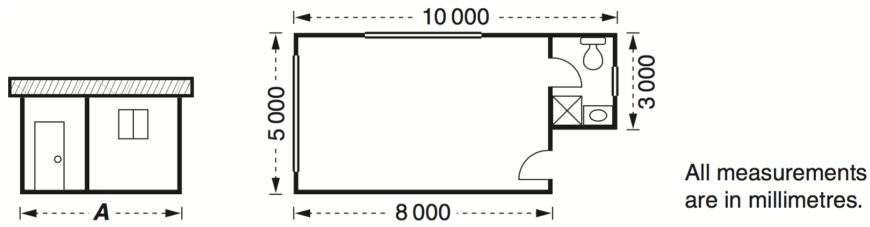
Part of the floor plan of a house is shown. The plan is drawn to scale.



- (i) What is the width of the stairwell, in millimetres? (1 mark)
- (ii) What are the internal dimensions of the bathroom, in millimetres? (1 mark)
- (iii) What is the length AB , the internal length of the rumpus room, in millimetres? (1 mark)

8. Measurement, 2UG 2010 HSC 23b

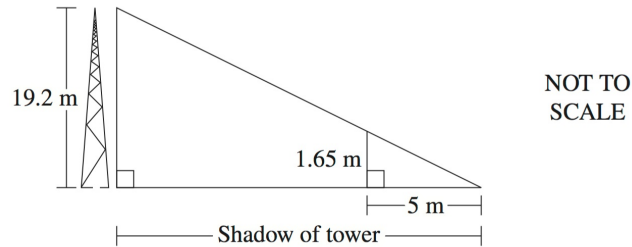
The elevation and floor plan of a building are shown.



Calculate the area of the floor of this building in square metres. (2 marks)

9. Measurement, 2UG 2015 HSC 27a

At a particular time during the day, a tower of height 19.2 metres casts a shadow. At the same time, a person who is 1.65 metres tall casts a shadow 5 metres long.



What is the length of the shadow cast by the tower at that time? (2 marks)

10. Measurement, STD2 M7 SM-Bank 06

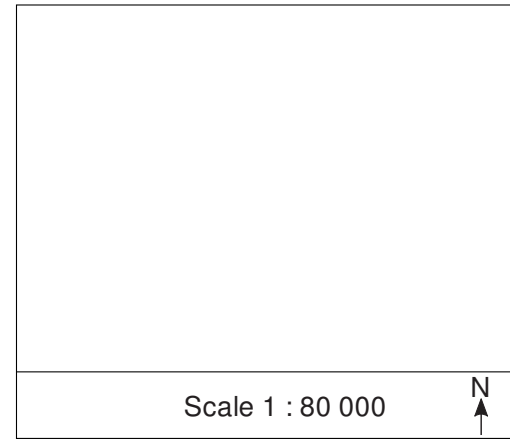
In a raffle, the total prize money is shared among the first two tickets drawn in the ratio 6:4.

The prize for the second ticket drawn is \$360.

What is the total prize money? (2 marks)

11. Measurement, STD2 M7 SM-Bank 07

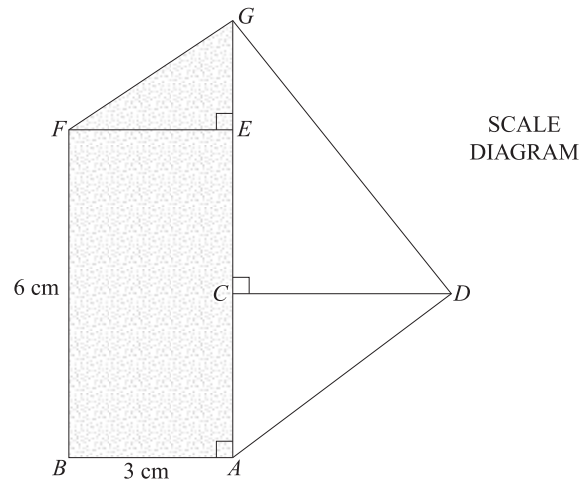
Part of a map is shown.



The distance between two points on the above map (not shown) is 3.4 kilometres. How far apart on the map would the two points be, in centimetres? (2 marks)

12. Measurement, 2UG 2018 HSC 26g

A field diagram of a block of land has been drawn to scale. The shaded region **ABFG** is covered in grass.



The actual length of **AG** is 24 m.

- i. If the length of **AG** on the field diagram is 8 cm, what is the scale of the diagram? (1 mark)
- ii. How much fertiliser would be needed to fertilise the grassed area **ABFG** at the rate of 26.5 g/m²? (3 marks)

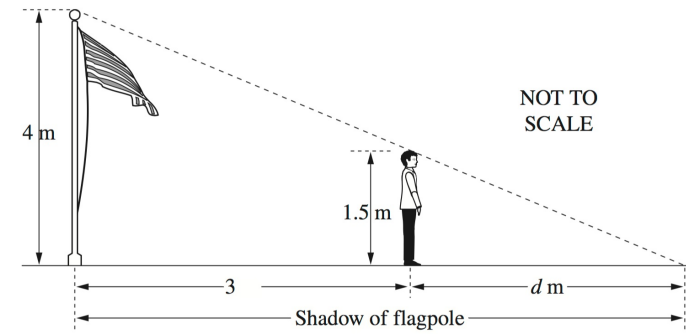
13. Measurement, 2UG 2012 HSC 27c

A map has a scale of 1 : 500 000.

- (i) Two mountain peaks are 2 cm apart on the map.
What is the actual distance between the two mountain peaks, in kilometres? (1 mark)
- (ii) Two cities are 75 km apart. How far apart are the two cities on the map, in centimetres?
(1 mark)

14. Measurement, 2UG 2012 HSC 28c

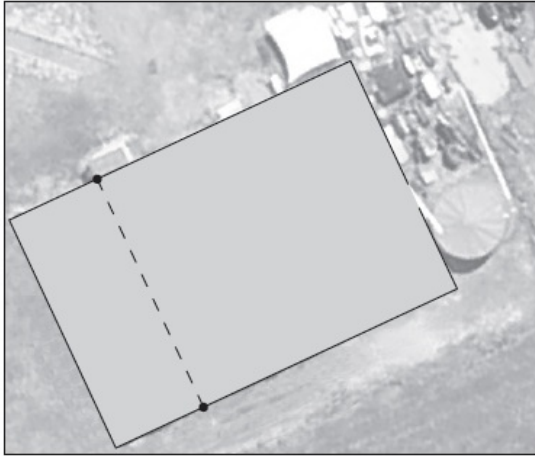
Jacques and a flagpole both cast shadows on the ground. The difference between the lengths of their shadows is 3 metres.



What is the value of **d**, the length of Jacques' shadow? (3 marks)

15. Measurement, 2UG 2015 HSC 29c

The image shows a rectangular farm shed with a flat roof.



The real width of the shed indicated by the dotted line was measured using an online ruler tool, and found to be approximately 12 metres.

- (i) By measurement and calculation, show that the area of the roof of the shed is approximately 216 m^2 . (2 marks)
- (ii) All the rain that falls onto this roof is diverted into a cylindrical water tank which has a diameter of 3.6 m. During a storm, 5 mm of rain falls onto the roof.

Calculate the increase in the depth of water in the tank due to the rain that falls onto the roof during the storm. (3 marks)

Worked Solutions

1. Measurement, 2UG 2007 HSC 4 MC

Take two corresponding sides

In ΔA 3 cm

In ΔB $1 \frac{1}{2}$ cm

\therefore Scale factor converting ΔA to $\Delta B = \frac{1}{2}$

$\Rightarrow A$

2. Measurement, 2UG 2005 HSC 4 MC

Wingspan is 3 times the scale distance that equals 1 cm.

\therefore Wingspan = 3×1
= 3 cm

$\Rightarrow B$

3. Measurement, STD2 M7 SM-Bank 03 MC

Males: Females

8: (24 - 8)

8:16

1:2

$\Rightarrow B$

4. Measurement, 2UG 2008 HSC 20 MC

Triangles are similar (2 \angle s same)

In smaller triangle

$$h^2 = 2^2 + 3^2 \\ = 13$$

$$h = \sqrt{13}$$

$$\frac{x}{8} = \frac{\sqrt{13}}{2} \quad (\text{sides of similar } \Delta\text{s same ratio})$$

$$x = \frac{8\sqrt{13}}{2}$$

$$= 14.422\dots$$

$\Rightarrow D$

5. Measurement, 2UG 2016 HSC 16 MC

Using similar ratios,

$$\frac{W}{7.1} = \frac{20.3}{8.1}$$

$$\therefore W = \frac{20.3 \times 7.1}{8.1}$$

$$= 17.79\dots$$

$\Rightarrow A$

6. Measurement, 2UG 2013 HSC 17 MC

We know $\triangle ABC \parallel \triangle DEF$

◆ Mean mark 38%

$$\therefore \frac{AB}{AC} = \frac{y}{10} = \frac{DE}{DF} = \frac{x}{15}$$

$$\frac{x}{15} = \frac{y}{10}$$

$$x = y \times \frac{15}{10}$$

$\Rightarrow C$

7. Measurement, 2UG 2011 HSC 24a

(i) 900 mm

(ii) 2000 mm \times 2000 mm

(iii) Length of Rumpus Room = AB

$$AB = 3600 + 90 + 2000 + 90 + 3915 \\ = 9695 \text{ mm}$$

8. Measurement, 2UG 2010 HSC 23b

MARKER'S COMMENT: Less errors were made by students who converted to metres *FIRST*, before calculating the area.

$$\text{Floor Area} = \text{Area 1} + \text{Area 2}$$

$$= (8 \times 5) + (2 \times 3) \quad (1 \text{ m} = 1000 \text{ mm})$$

$$= 46 \text{ m}^2$$

9. Measurement, 2UG 2015 HSC 27a

Both triangles have right angles and a common angle to the ground.

\therefore Triangles are similar (equiangular)

Let x = length of tower shadow

$$\frac{x}{19.2} = \frac{5}{1.65} \quad (\text{corresponding sides of similar triangles})$$

$$x = \frac{5 \times 19.2}{1.65}$$

$$= 58.1818\dots$$

$$= 58 \text{ m (nearest m)}$$

10. Measurement, STD2 M7 SM-Bank 06

$$\frac{4}{10} \times \text{Total prize money} = \$360$$

$$\Rightarrow \frac{1}{10} \times \text{Total prize money} = \$90$$

$$\begin{aligned} \therefore \text{Total prize money} &= 90 \times 10 \\ &= \$900 \end{aligned}$$

11. Measurement, STD2 M7 SM-Bank 07

Actual distance on map

$$= \frac{\text{real distance}}{\text{scale}}$$

$$= \frac{3.4 \text{ km}}{80\,000}$$

$$= \frac{3400 \text{ m}}{80\,000}$$

$$= 0.0425 \text{ m}$$

$$= 4.25 \text{ cm}$$

12. Measurement, 2UG 2018 HSC 26g

i. Scale 8 cm : 24 m

$$1 \text{ cm} : 3 \text{ m}$$

ii. Area of rectangle $ABFE$

$$= 6 \text{ cm} \times 3 \text{ cm}$$

$$= 18 \text{ m} \times 9 \text{ m}$$

$$= 162 \text{ m}^2$$

Area of $\triangle EFG$

$$= \frac{1}{2} \times 3 \text{ cm} \times 2 \text{ cm}$$

$$= \frac{1}{2} \times 9 \times 6$$

$$= 27 \text{ m}^2$$

$$\begin{aligned} \therefore \text{Fertiliser needed} &= (162 + 27) \times 26.5 \\ &= 5008.5 \text{ grams} \end{aligned}$$

◆◆ Mean mark 32%.

13. Measurement, 2UG 2012 HSC 27c

(i) Actual distance (2 cm) = 2 × 500 000

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

$$= 10\,000 \text{ m}$$

$$= 10 \text{ km}$$

∴ The 2 mountain peaks are 10 km apart.

(ii) Cities are 75 km apart.

From part (i), we know 2 cm = 10 km

$$\Rightarrow 1 \text{ cm} = 5 \text{ km}$$

$$\Rightarrow \text{On the map, } 75 \text{ km} = \frac{75}{5} = 15 \text{ cm}$$

∴ Distance on the map is 15 cm.

◆ Mean mark 37%
MARKER'S COMMENT: Better responses realised that 1 unit on the map represented 1 unit x 500,000 in real life.

◆ Mean mark 44%

14. Measurement, 2UG 2012 HSC 28c

◆◆ Mean mark 24%

Both triangles have right-angles with a common (ground) angle.

∴ Triangles are similar (equiangular)

Since corresponding sides are in the same ratio

$$\frac{d}{1.5} = \frac{d+3}{4}$$

$$4d = 1.5(d+3)$$

$$8d = 3(d+3)$$

$$= 3d + 9$$

$$5d = 9$$

$$\therefore d = \frac{9}{5}$$

$$= 1.8 \text{ m}$$

15. Measurement, 2UG 2015 HSC 29c

i. By measurement,

Roof length = 1.5 times the roof width

Width = 12 m (given)

Length = 1.5×12

$$= 18 \text{ m}$$

∴ Area of roof = 12×18

$$= 216 \text{ m}^2 \dots \text{as required}$$

◆ Mean mark 35%.

ii. Volume of water

$$= Ah$$

$$= 216 \times 0.005 \quad (5 \text{ mm} = 0.005 \text{ m})$$

$$= 1.08 \text{ m}^3$$

◆◆◆ Mean mark 14%.

Volume of cylinder = $\pi r^2 h$

$$r = \frac{3.6}{2} = 1.8 \text{ m}$$

Find h when $V = 1.08 \text{ m}^3$,

$$\pi \times 1.8^2 \times h = 1.08$$

$$\therefore h = \frac{1.08}{\pi \times 1.8^2}$$

$$= 0.1061\dots \text{ m}$$

$$= 10.6 \text{ cm (to 1 d.p.)}$$