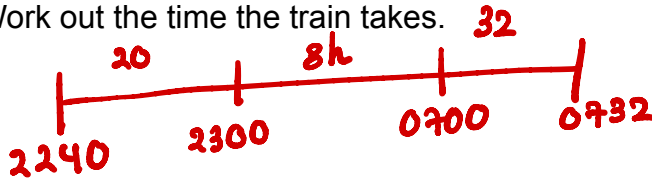


# E Maths Test

175 marks

1. A train leaves Zurich at 22 40 and arrives in Vienna at 07 32 the next day.

Work out the time the train takes.



..... 8 ..... h ..... 52 ..... min [1]

2. In a box of 80 glasses, 3 are broken.  
Work out the percentage of broken glasses in the box.

$$\frac{3}{80} \times 100 \quad \frac{30}{8}$$

..... 3.75 ..... % [1]

3. Here is a list of numbers.  
Put a ring around the number with the largest value.

0.3030     $\frac{1}{3}$     0.0330     $\frac{3}{10}$     33%

0.3    0.3

[1]

4. Chai says that  $8 \text{ cm}^2$  is the same as  $80 \text{ mm}^2$ .  
Explain why Chai is wrong.

$$8 \text{ cm}^2 = 8 \times 100 \text{ mm}^2$$
$$= 800 \text{ mm}^2$$

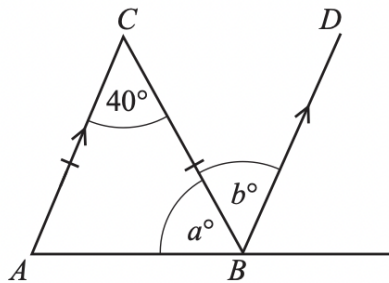
[1]

5.  $y = mx + c$ .  
Find the value of  $y$  when  $m = -2$ ,  $x = -7$  and  $c = -3$ .

$$y = -2(-7) - 3$$
$$= 14 - 3$$
$$= 11$$

$y = 11$  ..... [2]

6.



NOT TO  
SCALE

Triangle  $ABC$  is isosceles.

$AC$  is parallel to  $BD$ .

Find the value of  $a$  and the value of  $b$

$$a = \frac{180 - 40}{2} = 70'$$

$$a = 70'$$

$$b = 40' \quad [2]$$

7. Rearrange the formula  $5w - 3y + 7 = 0$  to make  $w$  the subject.

$$5w = 3y - 7$$

$$w = \frac{3y - 7}{5}$$

$$w = \frac{3y - 7}{5} \quad [2]$$

8. Explain why  $\sqrt{3}$  is irrational.

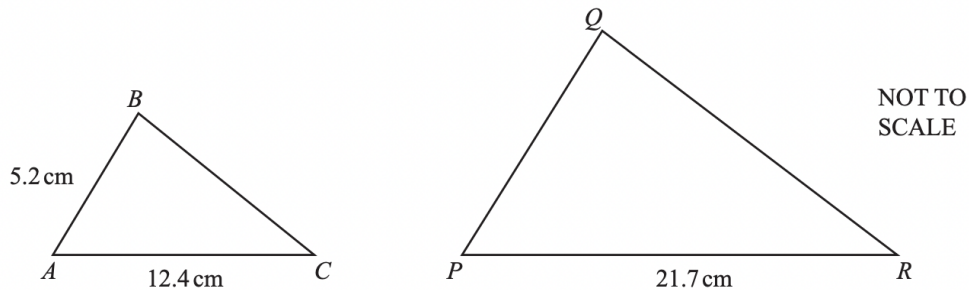
3 is not a square number..... [1]

9. The mass,  $m$  kilograms, of a horse is 429 kg, correct to the nearest kilogram.

Complete this statement about the value of  $m$ .

$$428.5 \leq m < 429.5 \quad [2]$$

10. Triangle  $ABC$  is similar to triangle  $PQR$ .



Find  $PQ$ .

$$\begin{aligned} & \times 12.4 \\ & \left( \frac{PQ}{21.7} \right) = \left( \frac{5.2}{12.4} \right) \times 21.7 \\ & \frac{12.4PQ}{269.08} = \frac{112.84}{269.08} \\ & 12.4PQ = 112.84 \\ & PQ = 9.1 \text{ cm} \end{aligned}$$

$$PQ = 9.1 \text{ cm} \quad [2]$$

11. Solve the inequality  $n + 7 < 5n - 8$ .

$$\begin{aligned} n - 5n &< -8 - 7 \\ -4n &< -15 \\ n &> 15/4 \end{aligned}$$

$$n > 15/4 \quad [2]$$

12. Without using your calculator, work out  $1\frac{7}{12} + \frac{13}{20}$ .

You must show all your working and give your answer as a mixed number in its simplest form.

$$\begin{aligned} & \frac{19 \times 20}{12 \times 20} + \frac{13 \times 12}{20 \times 12} \\ &= \frac{380}{240} + \frac{156}{240} \\ &= \frac{536 \div 8}{240 \div 8} \\ &= \frac{67}{30} \\ &= 2 \frac{7}{30} \end{aligned}$$

$2\frac{7}{30}$ ..... [3]

13. Here is a sequence of numbers.

7, 5, 3, 1, -1, ...

a. Find the next term in this sequence.

$-3$ ..... [1]

b. Find an expression for the  $n$ th term of this sequence.

$$\begin{aligned} & a + (n-1)d \\ & 7 + (n-1) \times -2 \\ & 7 - 2n + 2 \\ & -2n + 9 \end{aligned}$$

$-2n + 9$ ..... [2]

14. A hexagon has five angles that each measure  $115^\circ$ .

Calculate the size of the sixth angle.

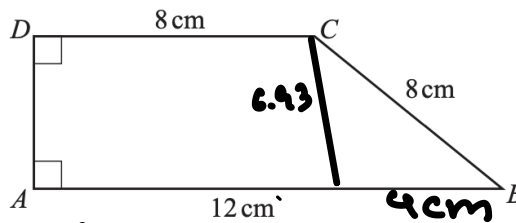
$$\begin{array}{r} 115 \\ \times 5 \\ \hline 575 \end{array}$$

$$\begin{aligned} \text{hexagon} &= (180(6 - 2)) \\ &= 720^\circ \\ 6^{\text{th}} \text{ angle} &= 720 - 575 \\ &= 145^\circ \end{aligned}$$

.....  $145^\circ$  ..... [3]

15. Calculate the area of this trapezium.

$$\begin{aligned} 8^2 &= 4^2 + x^2 \\ 64 &= 16 + x^2 \\ x^2 &= 64 - 16 \\ x^2 &= 48 \\ x &= \sqrt{48} = 6.93 \end{aligned}$$



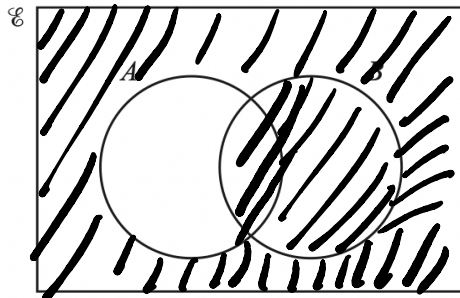
NOT TO SCALE

$$\begin{aligned} \text{Area} &= \frac{1}{2}(a+b)h \\ &= \frac{1}{2}(8+12)6.93 \\ &= 10 \times 6.93 \\ &= 69.3 \text{ cm}^2 \end{aligned}$$

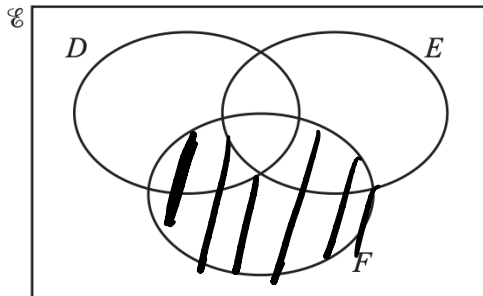
.....  $69.3$  .....  $\text{cm}^2$  [4]

16. Shade the region in each of the Venn diagrams below.

a.



b.



$A' \cup B$

$(D \cap E)' \cap F$

[4]

17.  $AB$  is an arc of a circle, centre  $O$ , radius 9 cm.

The length of the arc  $AB$  is  $6\pi$  cm.

The area of sector  $AOB$  is  $k\pi$  cm<sup>2</sup>.

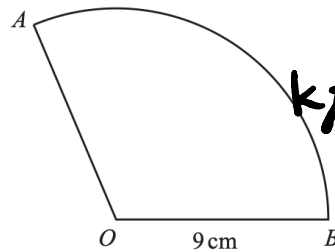
Find the value of  $k$ .

$$\text{length} = \frac{\theta}{360} \times 2\pi r$$

$$6\pi = \frac{\theta}{360} \times 2\pi \times 9$$

$$\frac{1}{3} = \frac{\theta}{360}$$

$$\theta = 120$$



$$k\pi = \frac{120}{360} \times \pi r^2$$

$$= \frac{1}{3} \times \pi \times 81$$

$$k\pi = 27\pi$$

$$k = 27$$

$$k = 27 \dots\dots\dots [3]$$

18.

a. Simplify  $(27x^6)^{\frac{1}{3}}$ .

$$(3^3 x^6)^{\frac{1}{3}}$$

$$= 3x^2$$

$$\dots\dots\dots 3x^2 \dots\dots\dots [2]$$

b. Find the value of  $(64x^4)^{0.5} \times 4x^{-2}$ .

$$= (8^2 x^4)^{\frac{1}{2}} \times 4x^{-2}$$

$$= 8x^2 \times 4x^{-2}$$

$$= 32$$

$$32 \dots\dots\dots [3]$$

19. Solve the simultaneous equations. You must show all your working.

$$y = 5x^2 + 4x - 19 \quad \text{--- } \textcircled{1}$$

$$y = 4x + 1 \quad \text{--- } \textcircled{2}$$

$$5x^2 + \cancel{4x} - 19 = \cancel{4x} + 1$$

$$5x^2 - 20 = 0$$

$$x^2 - 4 = 0$$

$$(x - 2)(x + 2) = 0$$

$$x = 2 \text{ (or) } x = -2$$

sub  $x = 2$  in eq ②

$$y = 8 + 1$$

$$= 9$$

sub  $x = -2$  in eq ②

$$y = -7$$

$$x = \dots -2 \dots y = \dots -7 \dots$$

$$x = \dots 2 \dots y = \dots 9 \dots [5]$$

20. (a) Kristian and Stephanie share some money in the ratio 3 : 2. Kristian receives \$72.

(i) Work out how much Stephanie receives.

$$\frac{72}{3} = 24$$

$$\begin{array}{l} 3 : 2 \\ 72 : 48 \end{array}$$

$$\$ \dots 48 \dots [2]$$

(ii) Kristian spends 45% of his \$72 on a computer game. Calculate the price of the computer game.

$$\begin{aligned}
 &= \frac{45}{100} \times 72 \\
 &= \frac{9}{20} \times 72 \\
 &= \$32.4
 \end{aligned}$$

\$ 32.4 ..... [1]

(iii) Kristian also buys a meal for \$8.40 . Calculate the fraction of the \$72 Kristian has left after buying the computer game and the meal.

Give your answer in its lowest terms.

$$\begin{aligned}
 \text{Spent} &= 8.40 + 32.4 \\
 &= 40.8
 \end{aligned}$$

$$\text{left} = 72 - 40.8$$

$$= 31.2$$

$$\begin{aligned}
 \frac{31.2}{72} &= \frac{312 \div 3}{720 \div 3} \\
 &= \frac{104 \div 4}{240 \div 4} \\
 &= \frac{26 \div 2}{60 \div 2} = \frac{13}{30}
 \end{aligned}$$

$$\frac{13}{30}$$

..... [2]

(iv) Stephanie buys a book in a sale for \$19.20 . This sale price is after a reduction of 20%.

Calculate the original price of the book.

$$80\% = 19.20 \text{ (sale price)}$$

$$10\% = 2.40$$

$$20\% = 4.8$$

$$\begin{aligned}
 \text{original price} &= 19.20 + 4.8 \\
 &= \$24
 \end{aligned}$$

\$ 24 ..... [3]



(b) Boris invests \$550 at a rate of 2% per year simple interest.

Calculate the value of the investment at the end of 10 years.

$$= \frac{2}{100} \times 550$$

$$= 11 \times 10$$

$$= 110$$

$$\text{After 10 years} = 550 + 110 \dots$$
$$= 660$$

\$ 660 ..... [3]

(c) Marlene invests \$550 at a rate of 1.9% per year compound interest. Calculate the value of the investment at the end of 10 years.

$$V = P \times \left(1 + \frac{r}{100}\right)^t$$
$$= 550 \times \left(1 + \frac{1.9}{100}\right)^{10}$$
$$= 663.9$$

\$ 663.9 ..... [2]

(d) Hans invests \$550 at a rate of  $x\%$  per year compound interest.

At the end of 10 years, the value of the investment is \$638.30, correct to the nearest cent.

Find the value of  $x$ .

$$V = P \times \left(1 + \frac{r}{100}\right)^t$$
$$638.30 = 550 \times \left(1 + \frac{x}{100}\right)^{10}$$
$$x = 1.5$$

$x =$  1.5 ..... [3]

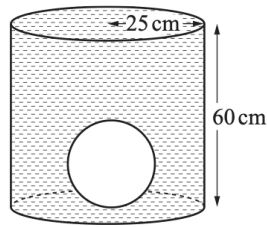
21. (a) Show that the volume of a metal sphere of radius 15 cm is  $14140 \text{ cm}^3$ , correct to 4 significant figures.

[The volume,  $V$ , of a sphere with radius  $r$  is  $V = \frac{4}{3}\pi r^3$ ]

$$\begin{aligned} V &= \frac{4}{3}\pi r^3 \\ &= \frac{4}{3} \times \pi \times 15^3 \\ &= 14137 \\ &= 14140 \text{ cm}^3 \end{aligned}$$

[2]

(b) (i) The sphere is placed inside an empty cylindrical tank of radius 25 cm and height 60 cm. The tank is filled with water.



NOT TO SCALE

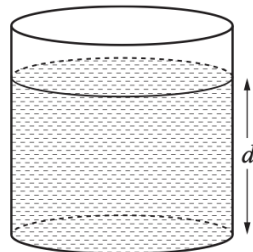
$$\begin{aligned} \text{V of cylinder} &= \pi r^2 h \\ &= \pi \times 25^2 \times 60 \\ &= 117810 \\ \text{V of sphere} &= 14140 \end{aligned}$$

Calculate the volume of water needed to fill the tank.

$$\begin{aligned} \text{Volume of water needed} &= 117810 - 14140 \\ &= 103670 \text{ cm}^3 \end{aligned}$$

.....103670.....cm<sup>3</sup> [3]

(ii) The sphere is removed from the tank.



NOT TO SCALE

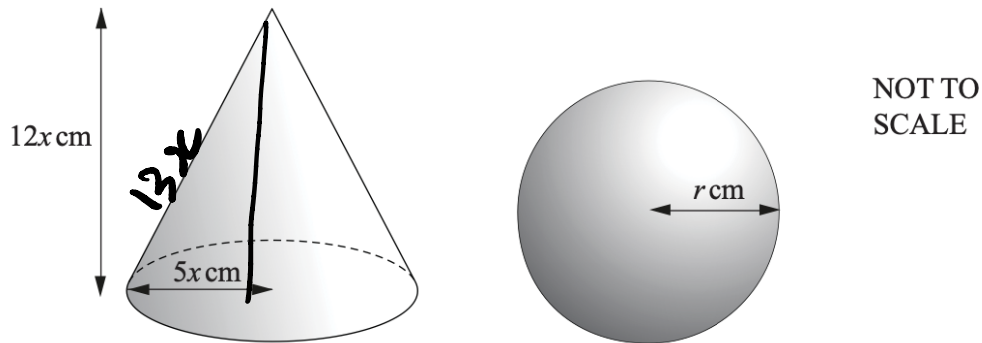
Calculate the depth,  $d$ , of water in the tank.

$$\begin{aligned} \pi r^2 h &= 103670 \\ \pi \times 625 \times h &= 103670 \end{aligned}$$

$$\begin{aligned} h &= \frac{103670}{625\pi} \\ &= 52.8 \end{aligned}$$

$d = 52.8$ .....cm [2]

(c) The diagram below shows a solid circular cone and a solid sphere.



The cone has radius  $5x$  cm and height  $12x$  cm.

The sphere has radius  $r$  cm.

The cone has the same **total** surface area as the sphere.

Show that  $r^2 = \frac{45}{2}x^2$ .

[The curved surface area,  $A$ , of a cone with radius  $r$  and slant height  $l$  is  $A = \pi rl$ .] [The surface area,  $A$ , of a sphere with radius  $r$  is  $A = 4\pi r^2$ .]

$$\begin{aligned} (\text{slant height})^2 &= (5x)^2 + (12x)^2 \\ h^2 &= 25x^2 + 144x^2 \\ h^2 &= 169x^2 \\ h &= \sqrt{169x^2} = 13x \end{aligned}$$

[5]

$$\begin{aligned} 4\pi r^2 &= \pi r l + \pi r^2 \\ 4\pi r^2 &= \pi (r l + r^2) \\ 4\pi r^2 &= \pi (65x^2 + 25x^2) \\ r^2 &= \frac{90}{4} x^2 \\ r^2 &= \frac{45}{2} x^2 \end{aligned}$$