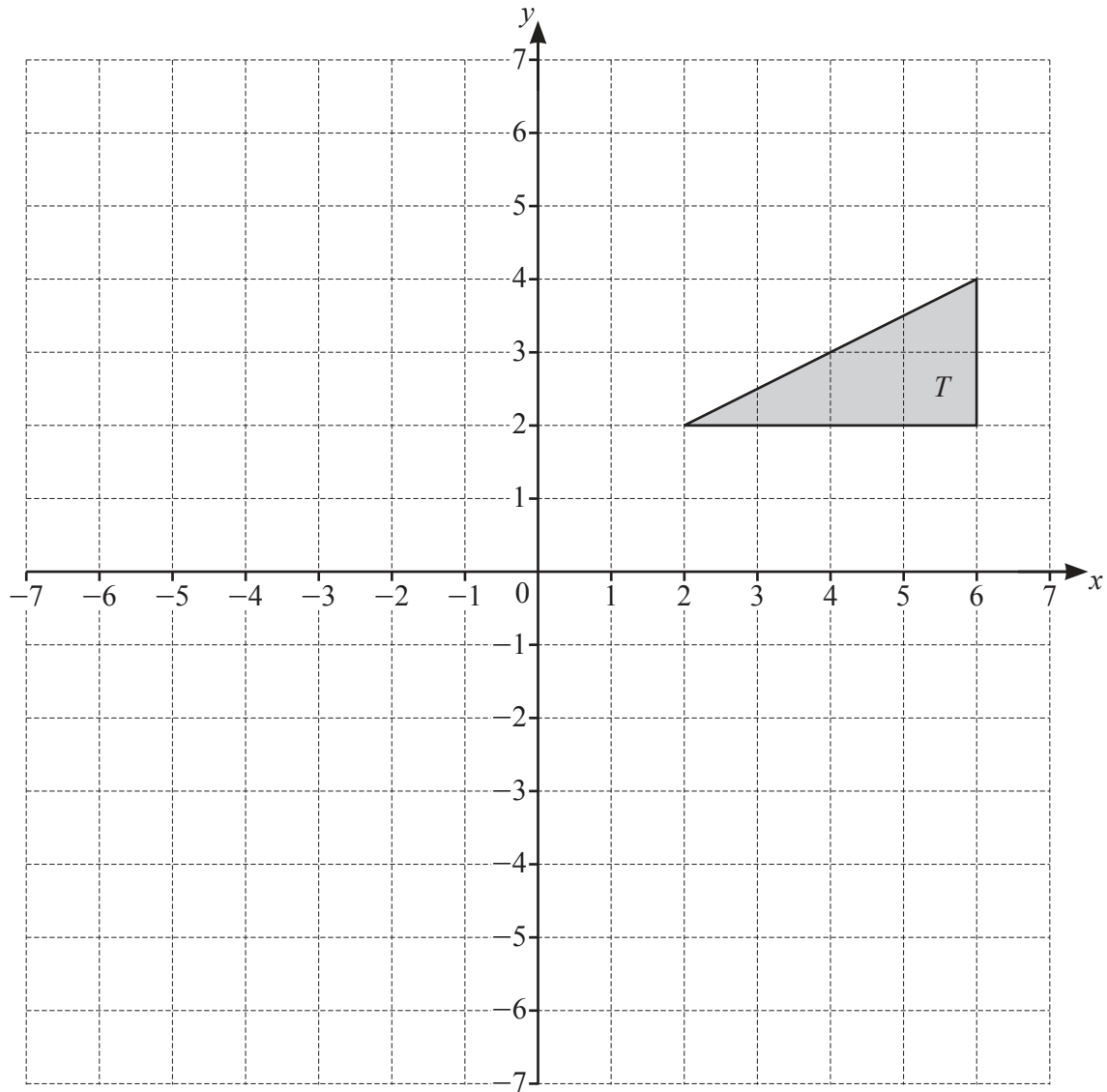




1



- (a) (i) Translate triangle  $T$  by the vector  $\begin{pmatrix} -7 \\ 1 \end{pmatrix}$ . Label the image  $K$ . [2]

(ii) Describe fully the **single** transformation that maps triangle  $K$  onto triangle  $T$ .

.....

..... [1]

- (b) Reflect triangle  $T$  in the line  $y = 4$ . [2]

- (c) Rotate triangle  $T$  through  $90^\circ$  clockwise about  $(0, 0)$ . [2]

- (d) (i) Enlarge triangle  $T$  by scale factor  $-\frac{1}{2}$ , centre  $(0, 0)$ . Label the image  $P$ . [2]

(ii) Describe fully the **single** transformation that maps triangle  $P$  onto triangle  $T$ .

.....

..... [2]

- 2 (a) Daisy records her 50 homework marks.  
The table shows the results.

Homework mark	15	16	17	18	19	20
Frequency	1	3	19	11	10	6

- (i) Write down the range.

..... [1]

- (ii) Write down the mode.

..... [1]

- (iii) Find the median.

..... [1]

- (iv) Calculate the mean.

..... [3]

- (b) 21 33 20 25 21 34 22 21 20 30 18

The list shows Ed's scores in 11 tests.

- (i) Complete the stem-and-leaf diagram to show this information.

1	
2	
3	

Key: 2|5 represents 25

[2]

- (ii) Find the median.

..... [1]

- (iii) Find the interquartile range.

..... [2]

- 3 (a) The value of Priya's car decreases by 10% every year.  
The value today is \$7695.

(i) Calculate the value of the car after one year.

\$ ..... [2]

(ii) Calculate the value of the car one year ago.

\$ ..... [2]

- (b) Ali invests \$600 at a rate of 2% per year simple interest.

Calculate the value of Ali's investment at the end of 5 years.

\$ ..... [3]

- (c) Sara invests \$500 at a rate of  $r\%$  per year compound interest.  
At the end of 12 years, the value of Sara's investment is \$601.35, correct to the nearest cent.

Find the value of  $r$ .

$r =$  ..... [3]

(d) The mass of a radioactive substance decreases exponentially at a rate of 3% each day.

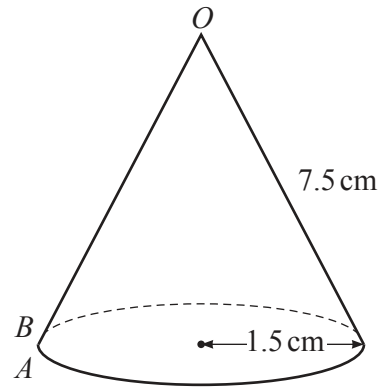
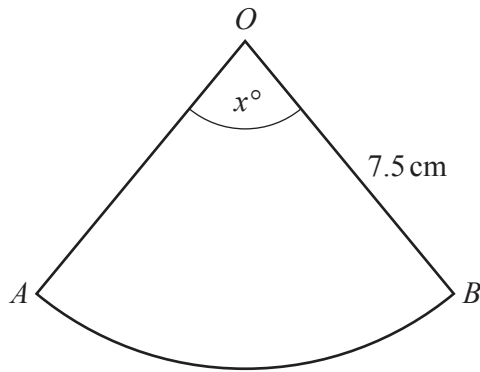
(i) Find the overall percentage decrease at the end of 10 days.

..... % [2]

(ii) Find the number of whole days it takes until the mass of this substance is one half of its original amount.

..... [3]

4 (a)

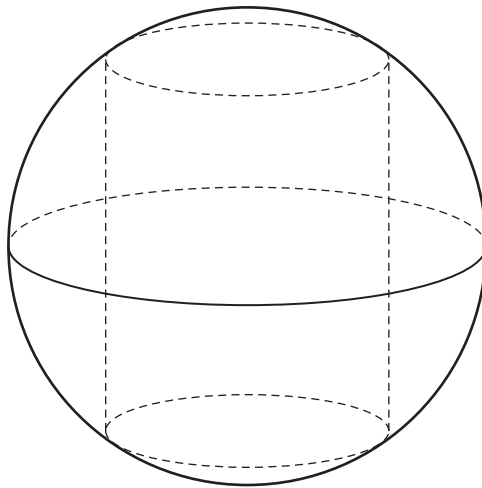
NOT TO  
SCALE

The diagram shows a sector of a circle that is made into a cone by joining  $OA$  to  $OB$ .  
The sector angle is  $x^\circ$  and the radius of the sector is 7.5 cm.  
The base radius of the cone is 1.5 cm.

Calculate the value of  $x$ .

$x = \dots\dots\dots$  [3]

(b)

NOT TO  
SCALE

The diagram shows a cylinder with radius 8 cm inside a sphere with radius 17 cm.  
Both ends of the cylinder touch the curved surface of the sphere.

(i) Show that the height of the cylinder is 30 cm.

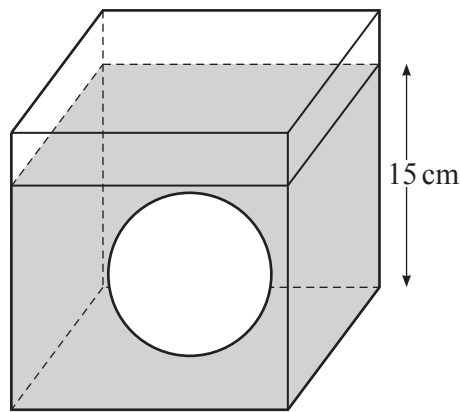
[2]

- (ii) Calculate the volume of the cylinder as a percentage of the volume of the sphere.

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

..... % [4]

(c)



NOT TO  
SCALE

The diagram shows a solid sphere with radius 6 cm inside a cube with side length 20 cm.  
The cube contains water to a depth of 15 cm.  
The sphere is removed.

Calculate the new depth of water in the cube.

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

..... cm [3]

[Turn over

- 5 (a) In a shop the cost of a fiction book is  $\$x$  and the cost of a reference book is  $\$(x+2)$ .  
The cost of 11 fiction books is the same as the cost of 10 reference books.

Find the value of  $x$ .

$$x = \dots\dots\dots [2]$$

- (b) In another shop, the cost of a fiction book is  $\$y$  and the cost of a reference book is  $\$(y+2)$ .  
Maria spends  $\$95$  on fiction books and  $\$147$  on reference books.  
She buys a total of 12 books.

- (i) Show that  $6y^2 - 109y - 95 = 0$ .

[4]

- (ii) Factorise  $6y^2 - 109y - 95$ .

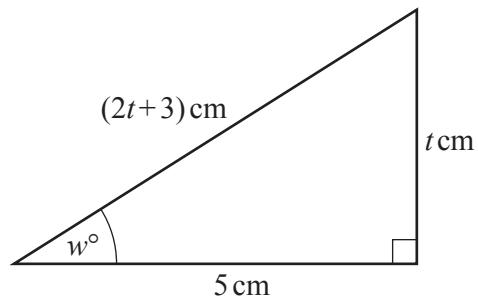
$$\dots\dots\dots [2]$$

- (iii) Find the value of  $y$ .

$$y = \dots\dots\dots [1]$$



6



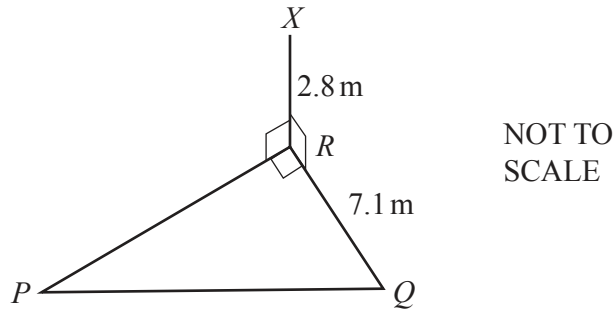
NOT TO  
SCALE

The diagram shows a right-angled triangle.

Find the value of  $w$ .

$w = \dots\dots\dots [7]$

7 (a)



The diagram shows a right-angled triangle  $PQR$  on horizontal ground.  $X$  is vertically above  $R$  and the angle of elevation of  $X$  from  $P$  is  $21^\circ$ .  $XR = 2.8\text{ m}$  and  $RQ = 7.1\text{ m}$ .

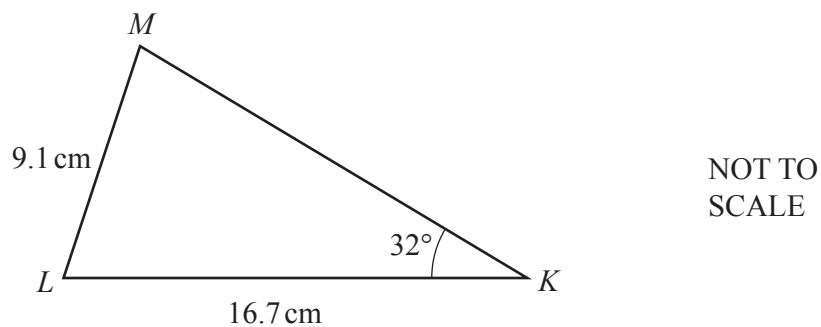
(i) Calculate the angle of elevation of  $X$  from  $Q$ .

..... [2]

(ii) Calculate  $PQ$ .

..... m [3]

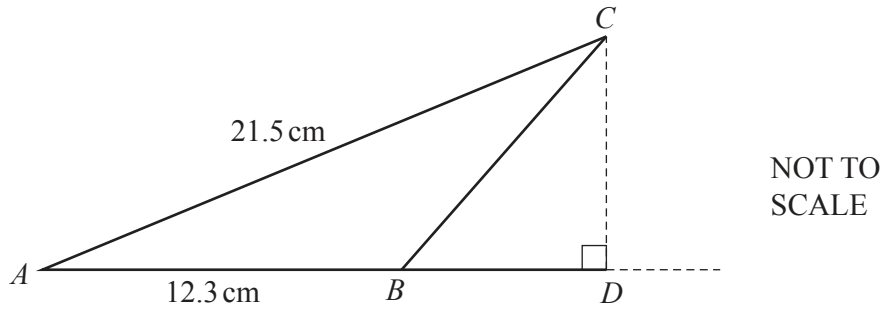
(b)



Calculate the acute angle  $KML$ .

Angle  $KML = \dots\dots\dots [3]$

(c)



The area of triangle  $ABC$  is  $62.89 \text{ cm}^2$ .

(i) Show that angle  $BAC = 28.4^\circ$ , correct to 1 decimal place.

[2]

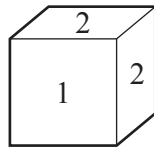
(ii) Calculate  $BC$ .

..... cm [3]

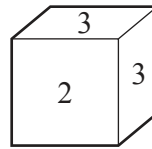
(iii)  $AB$  is extended to a point  $D$  such that angle  $BDC = 90^\circ$ .

Calculate  $BD$ .

..... cm [3]



Dice A



Dice B

The diagram shows two fair dice.

Dice A is numbered 1, 2, 2, 2, 3, 6.

Dice B is numbered 2, 3, 3, 4, 4, 4.

- (a) (i) Dice A is rolled once.

Write down the probability that it lands on the number 6.

..... [1]

- (ii) Dice A is rolled 150 times.

Find the number of times it is expected to land on the number 6.

..... [1]

- (b) Dice A and Dice B are each rolled once.

- (i) Find the probability that the two numbers they land on have a total of 6.

..... [3]

- (ii) Find the probability that when the two numbers they land on have a total of 6, both numbers are 3.

..... [2]

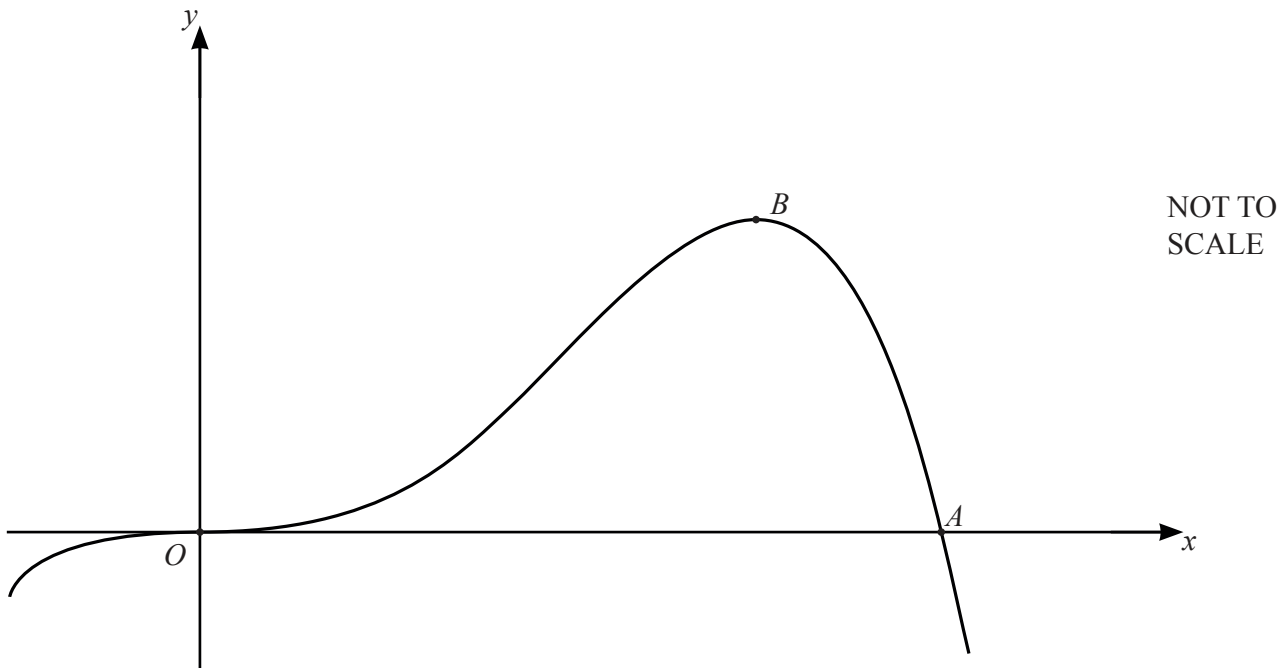
- (c) Dice B is rolled  $n$  times.

The probability that on the  $n$ th roll it first lands on a number 3 is  $\frac{32}{729}$ .

Find the value of  $n$ .

$n = \dots\dots\dots$  [2]

9



The diagram shows a sketch of the graph of  $y = 4x^3 - x^4$ .  
 The graph crosses the  $x$ -axis at the origin  $O$  and at the point  $A$ .  
 The point  $B$  is a maximum point.

(a) Differentiate  $4x^3 - x^4$ .

..... [2]

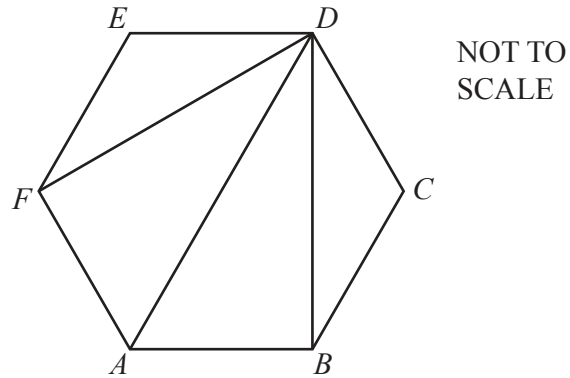
(b) Find the coordinates of  $B$ .

(....., ..... ) [3]

(c) Find the gradient of the graph at the point  $A$ .

..... [3]

10 (a)



$ABCDEF$  is a regular hexagon.  
 $DF$ ,  $DA$  and  $DB$  are diagonals.

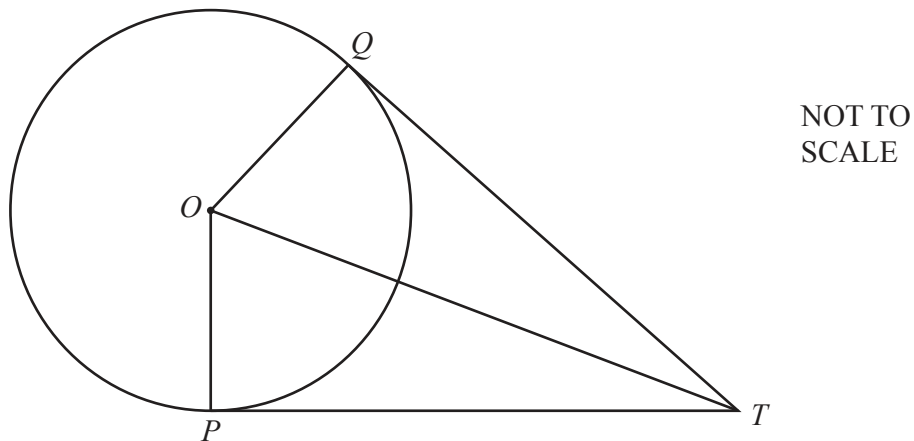
Complete the following statements using three different triangles.

Triangle  $DEF$  is congruent to triangle .....

Triangle ..... is congruent to triangle .....

[2]

(b)



$P$  and  $Q$  are points on the circle with centre  $O$ .  
 $TP$  and  $TQ$  are tangents to the circle from the point  $T$ .

Complete the following statements and reasons.

In triangles  $OPT$  and  $OQT$

$OP = \dots\dots\dots$  because each is a radius of the circle

$OT$  is a common side

Angle  $OPT = \text{angle } \dots\dots\dots = 90^\circ$  because .....

Triangles  $OPT$  and  $OQT$  are congruent using the criterion .....

This proves that the tangents  $TP$  and  $TQ$  are .....

[5]

11       $f(x) = 1 - 3x$        $g(x) = (x - 1)^2$        $h(x) = \frac{3}{x}, x \neq 0$

(a) Find  $g(3)$ .

..... [1]

(b) Find  $f(x-2)$ , giving your answer in its simplest form.

..... [2]

(c) Find  $f^{-1}(x)$ .

$f^{-1}(x) =$  ..... [2]

(d)  $gf(x) - g(x)f(x) = 3x^3 + ax^2 + bx + c$

Find the value of each of  $a$ ,  $b$  and  $c$ .

$a =$  .....

$b =$  .....

$c =$  ..... [5]



(e) Find  $h(x) - f(x)$ , giving your answer as a single fraction in its simplest form.

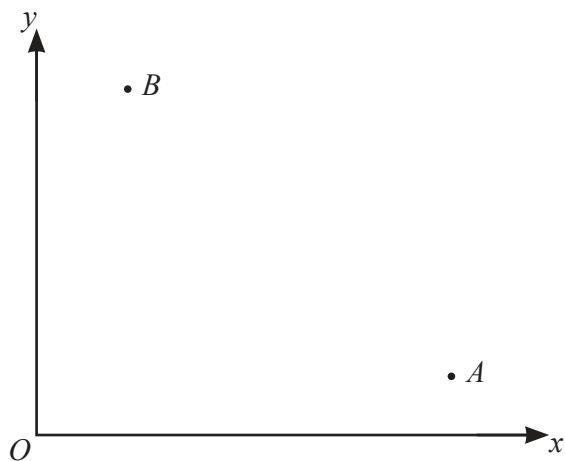
..... [3]

(f)  $h(x^n) = 3x^7$

Find the value of  $n$ .

$n =$  ..... [1]

12

NOT TO  
SCALE

$O$  is the origin  $(0, 0)$ ,  $A$  is the point  $(8, 1)$  and  $B$  is the point  $(2, 5)$ .

(a) Write as column vectors.

(i)  $\overrightarrow{OB}$

$$\overrightarrow{OB} = \begin{pmatrix} \phantom{0} \\ \phantom{0} \end{pmatrix} \quad [1]$$

(ii)  $\overrightarrow{AB}$

$$\overrightarrow{AB} = \begin{pmatrix} \phantom{0} \\ \phantom{0} \end{pmatrix} \quad [1]$$

(b) Find the equation of the line  $AB$ .

Give your answer in the form  $y = mx + c$ .

$$y = \dots\dots\dots [3]$$

- (c) Find the equation of the perpendicular bisector of  $AB$ .  
Give your answer in the form  $y = mx + c$ .

$y = \dots\dots\dots$  [4]

- (d) The line  $AB$  meets the  $y$ -axis at  $P$ .  
The perpendicular bisector of  $AB$  meets the  $y$ -axis at  $Q$ .

Find the length of  $PQ$ .

$\dots\dots\dots$  [2]

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