

Question 1**(25 marks)**

(a) Use your calculator to answer the following.

(i) Write $0.\dot{2}\dot{3}$ as a fraction

$$\frac{23}{99}$$

(ii) Find 12.47% of €25,000, correct to the nearest euro.

$$(12.47\%)(25,000) = €3,117.5 = €3,118$$

(iii) Evaluate $\frac{3\pi}{\sqrt{7}} \times \cos 87^\circ$, correct to 2 decimal places.

$$\begin{aligned}\frac{3\pi}{\sqrt{7}} \times (\cos 87^\circ) &= 0.186432 \\ &= 0.19\end{aligned}$$

(b) The Search Engine Google takes its name from the word *googol*. A googol is the number 1 followed by one hundred zeros. Write this number in scientific notation.

$$10 = (1) \times (10)$$

$$100 = (1) \times (10^2)$$

$$1000 = (1) \times (10^3)$$

$$10000000 \dots \dots = (1) \times (10^{100})$$

Question 2**(25 marks)**

(a) A newspaper states: 'It will most probably rain tomorrow.'

Which of the following best represents the probability of an event that will most probably occur? Circle the most appropriate answer and explain your answer.

33 % 50% **80%** 100%

Because this is the highest probability other than 100%. Something which is 100% is guaranteed to happen and the paper doesn't say this. So, 80% is the next best answer.

(b) Some men and women were surveyed at a football game. They were asked which team they supported. The results are shown in the two-way table.

	<i>Team A</i>	<i>Team B</i>	<i>Total</i>
<i>Men</i>	125	100	225
<i>Women</i>	200 – 125 = 75	165 – 75 = 90	165
<i>Total</i>	200	100 + 90 = 190	200 + 190 = 390 OR 225 + 165 = 390

(i) Complete the table above

(ii) What percentage of women surveyed supported Team B, correct to the nearest percent?

$$\frac{90}{165} \times 100 = 54.54\% = 55\%$$

(iii) What fraction of people, in its simplest form, support Team A?

$$\frac{200}{390} = \frac{20}{39}$$

Question 3**(25 marks)**

(a) A personal identification number (PIN) is made up of four digits. An example of a PIN is

0	2	2	9
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(i) When all ten digits are available for use, how many different PINs are possible?

$$10 \times 10 \times 10 \times 10 = 10,000$$

(ii) What is the probability that one such PIN number is 1234 in that order?

$$\left(\frac{1}{10}\right)\left(\frac{1}{10}\right)\left(\frac{1}{10}\right)\left(\frac{1}{10}\right) = \frac{1}{10,000}$$

(b) The diagram below shows a stem-and-leaf plot for 22 scores.

2		3	5	9	
3		1	4	7	9
4		2	2	2	5 7
5		1	2	4	
6		2	3	7	
7		5	8	8	8

(i) What is the mode for this data?

Mode = 78

(ii) What is the median for this data?

$$\frac{45 + 47}{2} = 46$$

Question 4**(25 marks)**

(a) For each of the following sequences of numbers, use the pattern to continue the sequence for two more terms:

(Multiply the previous term by 5)

(i) 7, 35, 175, 875, **4375, 21875**.

(Subtract 8 from the previous term)

(ii) 100, 92, 84, 76, **68, 60**.

(b) (i) Write 256 as 4^n , where $n \in \mathbb{N}$.

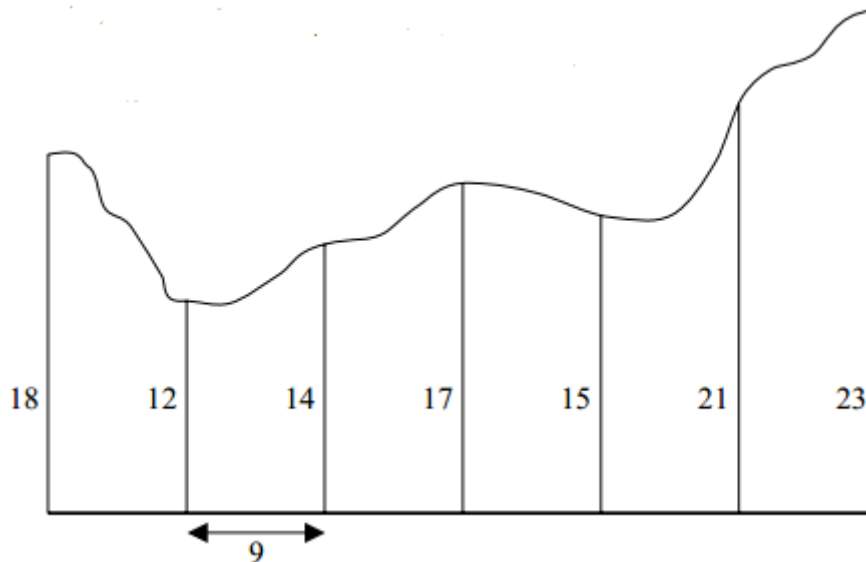
$$4^4 = 256$$

(ii) Find $81^{\frac{1}{2}}$.

$$(81)^{\frac{1}{2}} = \sqrt{81} = 9$$

Question 5**(25 marks)**

(a) A garden has one irregular side. Offsets of lengths 18, 12, 14, 17, 15, 21, and 23 metres are measured from the irregular side to the opposite side, as shown. The offsets are 9 metres apart.



(i) Calculate the area of the garden using the Trapezoidal Rule.

$$A = \frac{h}{2} [1^{st} + last + 2(\text{rest})]$$

$$A = \frac{9}{2} [18 + 23 + 2(12 + 14 + 17 + 15 + 21)]$$

$$A = \frac{9}{2} (41 + 2(79))$$

$$A = \frac{9}{2} [41 + 158]$$

$$A = \frac{9}{2} [199]$$

$$A = 895.5m^2$$

(b) Solve the quadratic equation $2x^2 + 5x - 1 = 0$.

Give your answers correct to two decimal places.

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-5 \pm \sqrt{5^2 - 4(2)(-1)}}{2(2)}$$

$$x = 0.18614 \dots \text{ and } x = -2.68614 \dots$$

$$x = 0.19 \text{ and } x = -2.69$$

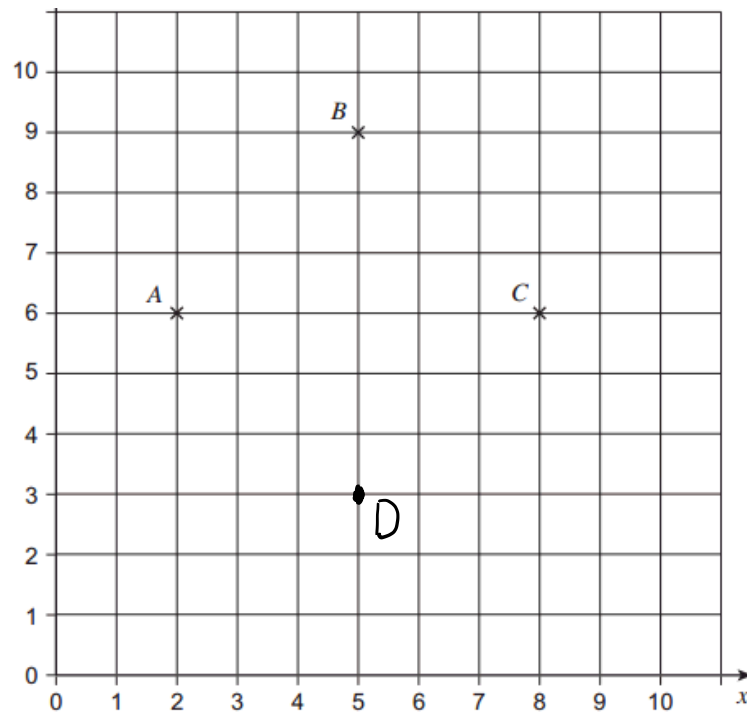
(c) €3500 is invested for four years at a fixed rate of compound interest. During the first year it earns €140.

What is the annual rate of interest?

$$i = \frac{140}{3500} \times 100 = 4\%$$

Question 6**(25 marks)**

(a) Here is a centimetre–square grid with points A, B and C plotted.



(i) Write down the coordinates of point A.

$$A = (2 , 6)$$

(ii) Plot the point D so that ABCD is a square.

(iii) Write down the coordinates of point D

$$D = (5,3)$$

(iv) Use a ruler to measure all four sides of your square. Write down the length of the sides.

$$= 4.2cm$$

(v) If each cm of your ruler represents a distance of 10 km on a map, find the total area of the square on the map.

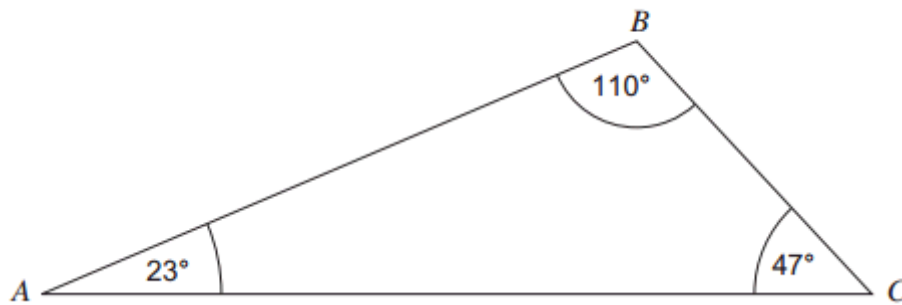
$$(4.2)(10) = 42km$$

$$A = (42)^2 = 1764km^2$$

Question 7

(25 marks)

The diagram shows a triangle ABC.



(a) (i) Circle the correct word to describe triangle ABC.

Scalene Isosceles Equilateral

(ii) Explain why you chose this word.

Because in a scalene triangle all the sides and angles are different.

(b) (i) From the diagram above, write down $\angle ABC$

$\angle ABC = 110^\circ$

(ii) Circle the correct word to describe angle $\angle ABC$

Acute

Obtuse

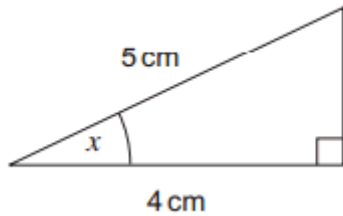
Reflex

(iii) Explain your answer.

An obtuse angle is between 90° and 180°

Question 8**(25 marks)**

(a) The diagram shows a right-angled triangle.



(i) Calculate the value of the unknown side using the Theorem of Pythagoras

$$h^2 = a^2 + o^2$$

$$5^2 = 4^2 + o^2$$

$$25 - 16 = o^2$$

$$\sqrt{9} = o$$

$$3 = o$$

(ii) Write down the value of $\sin x$ as a fraction

$$\sin x = \frac{o}{h}$$

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

(iii) Use this answer to find the angle x in the diagram above, correct to the nearest degree.

$$\sin^{-1} \frac{3}{5} = x$$

$$x = 36.8698^\circ$$

$$x = 37^\circ$$

(b) (i) Solve the simultaneous equations

$$3x - 4y = 18$$

$$x + 2y = -4$$

Solution

$$3x - 4y = 18$$

$$\underline{-3x - 6y = +12}$$

$$-10y = 30$$

$$y = \frac{30}{-10}$$

$$y = -3$$

$$x - 6 = -4$$

$$x = 6 - 4$$

$$x = 2 \text{ and } y = -3$$

(ii) Find the value of $8t^3 + 3t - 12$ when $t = 2$.

$$8(2)^3 + 3(2) - 12$$

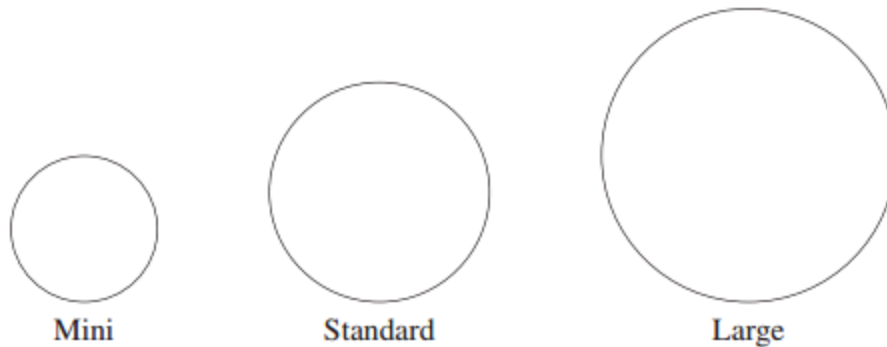
$$8(8) + 6 - 12$$

$$64 + 6 - 12$$

$$70 - 12 = 58$$

Question 9**(50 marks)**

(a) Joe's pizzas are made in three different sizes.



Joe puts olives on all his pizzas. The number of olives depends on the size of the pizza, as shown in the table.

<i>Size</i>	<i>Diameter, d, (cm)</i>	<i>Number of olives, n</i>
Mini	20	8
Standard	30	18
Large	40	32

The relationship between the diameter of the pizza, d , and the number of olives, n , can be expressed by the formula:

$$n = kd^2, \quad \text{where } k \text{ is a constant.}$$

(i) Use a pair of values from the table to show that $k = 0.02$.

$$8 = k(20)^2$$

$$8 = k(400)$$

$$\frac{8}{400} = k$$

$$0.02 = k$$

(ii) Joe decides to make a mega-pizza, with diameter 50 cm.

Use the formula to find the number of olives needed for a mega-pizza.

$$n = (0.02)(50)^2$$

$$n = 50$$

(b) Joe is asked to make a pizza in the shape of a square with sides of length 25 cm. He decides to use the same number of olives as would be needed on a round pizza with the same area. [You should write the radius of the new pizza correct to the nearest whole number]

How many olives will be needed?

$$A = (25)^2 = 625\text{cm}^2$$

$$\pi r^2 = 625$$

$$r^2 = \frac{625}{\pi}$$

$$r^2 = 198.9436$$

$$r = 14.104 \dots$$

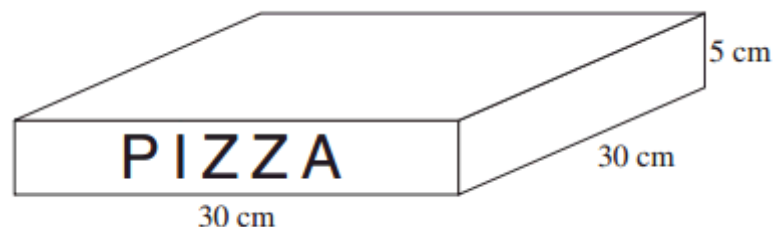
$$r = 14\text{cm}$$

$$d = 28\text{cm}$$

$$n = 0.02(28^2)$$

$$n = 15.68 \text{ olives}$$

(c) Joe's standard pizza boxes have dimensions as shown.



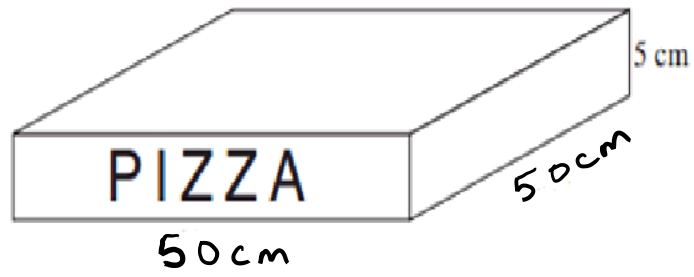
(i) What is the surface area of one box?

$$(30)(5)(4) = 600$$

$$(30)(30)(2) = 1800$$

$$1800 + 600 = 2400\text{cm}^2$$

(ii) Draw a picture to show the box needed for the new mega-pizza, similar to the one shown above in part (i). Put all the dimensions into your diagram.



(iii) What is the volume of this new box?

$$v = (50)(50)(3)$$

$$V = 7500\text{cm}^3$$

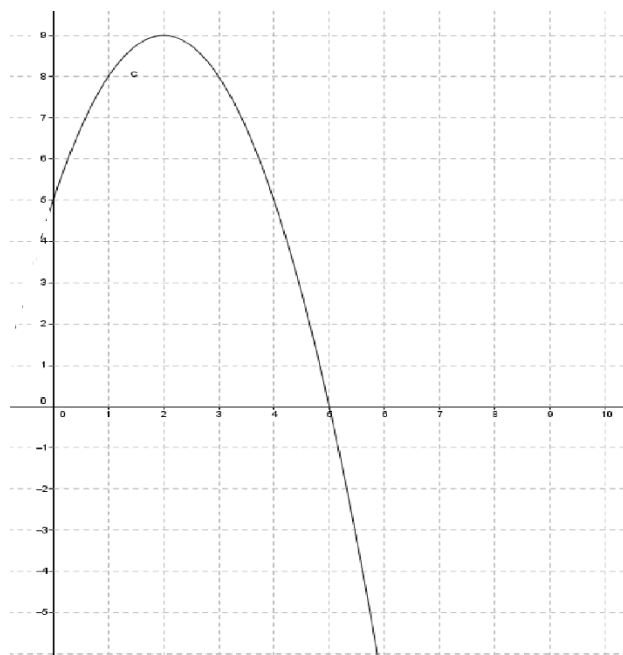
Question 10**(50 marks)**

A firework is fired upwards from the top of a building. The height, h metres, reached by the firework after t seconds, is given by $h = 5 + 4t - t^2$.

(i) By using your calculator, or otherwise, complete the table below.

t , seconds	0	1	2	3	4	5	6
h , metres	5	8	9	8	5	0	-7

(ii) Hence, or otherwise, graph the function of $h = 5 + 4t - t^2$, in the domain $0 \leq t \leq 6$.



(b) Use your graph to find

(i) the height of the building

Height of building = 5 metres

(ii) the maximum height reached by the firework

Max height reached by firework = 9 metres

(iii) the number of seconds taken for the firework to reach a height of 8 metres above the base of the building for the first time

= 1 second

(iv) how high the firework is after 4.5 seconds

= 2.75 metres

(c) Eoin thinks that there is something wrong with the firework by looking at the graph. Do you agree with Eoin? Explain your answer fully.

Yes, as it fails to explode mid-air as fireworks should!