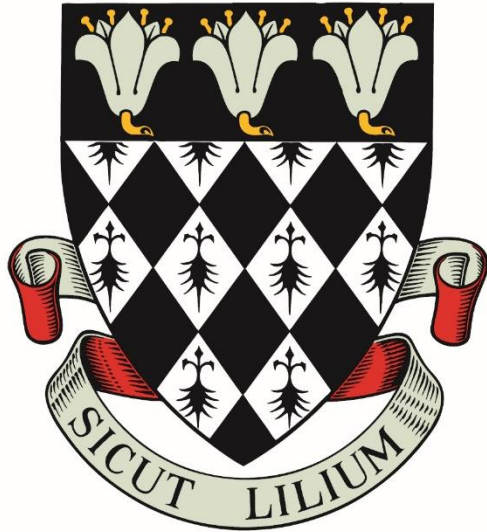


First name: \_\_\_\_\_ Surname: \_\_\_\_\_



# Magdalen College School

## Sample Scholarship Examination

### Mathematics

Please read the following information carefully before the examination starts.

- This examination is **60 minutes** long.
- Calculators **are** allowed.
- This test is designed to be challenging, so you may not find all the questions straightforward and you may not finish the whole paper.
- Read each question very carefully, think for a while and if you still do not understand what you need to do, then move on to the next question.
- All working and calculations should be written in the spaces provided on this paper. Marks are awarded for correct working, even if you don't get as far as an answer.
- The number of marks available for each question is shown in square brackets, like this: [3]. Please aim to try all questions.
- Work through the paper steadily and carefully. If you have time at the end, go back and try to tackle any questions you did not find so easy when you first saw them.
- Good luck!

1) Suppose  $p = 1$ ,  $q = 2$ ,  $r = 3$  and  $s = -2$ . Find the value of:

a)  $rs$

Answer a): \_\_\_\_\_ [1]

b)  $3q - 8$

Answer b): \_\_\_\_\_ [1]

c)  $s^2 - p$

Answer c): \_\_\_\_\_ [1]

d)  $s = ut + \frac{1}{2}at^2$

Calculate  $s$  if  $u = 21$ ,  $t = 2.137$  and  $a = \sqrt[3]{10}$  giving your answer correct to 2 decimal places.

Answer d):  $s =$  \_\_\_\_\_ (to 2 d.p.) [3]

2)

a) Expand  $3(x + y)$

Answer a): \_\_\_\_\_ [1]

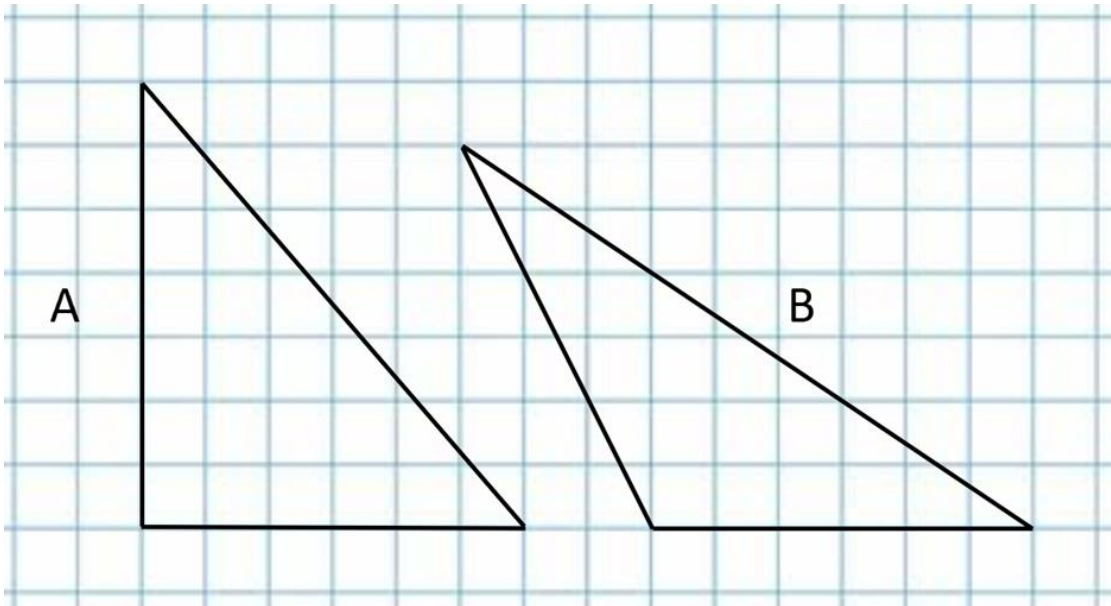
b) Factorise  $6a^2 + 3ab$

Answer b): \_\_\_\_\_ [1]

c) Solve  $3x - 8 = 5x + 2$

Answer c):  $x =$  \_\_\_\_\_ [3]

3) The following two triangles are drawn on unit square paper.



a) What is the area of triangle A in units<sup>2</sup>?

Answer a):  $A = \underline{\hspace{2cm}}$  units<sup>2</sup> [2]

b) What is the difference in the size in units<sup>2</sup> of these two triangles? An accurate answer is required for this question.

Answer a): difference in size =  $\underline{\hspace{2cm}}$  units<sup>2</sup> [3]

4) Solve the following equations, giving your answers as simplified fractions where appropriate.

a)  $5 + \frac{4}{x} = 2$

Answer a): \_\_\_\_\_ [3]

b)  $2(x + 3) - (3x + 4) = 8$

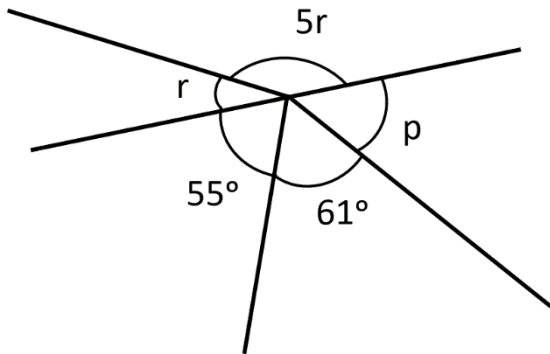
Answer b): \_\_\_\_\_ [3]

c)  $\frac{(3-x)}{x} = 5$

Answer c): \_\_\_\_\_ [3]

5) The diagrams in this question are not drawn to scale.

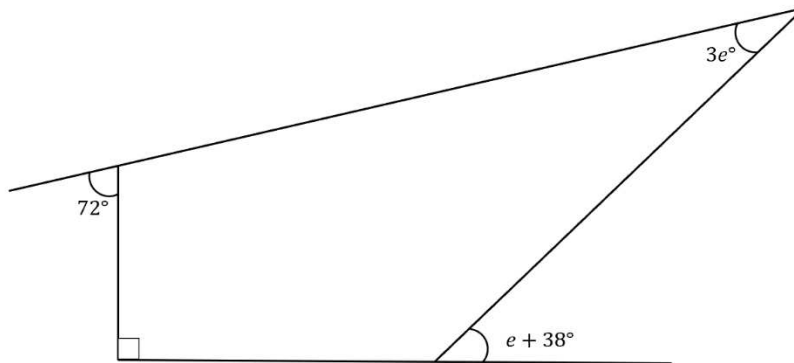
- a) Find the value of each of the marked angles and hence what angle each letter represents.



Answer :  $p =$  \_\_\_\_\_ [1]

$r =$  \_\_\_\_\_ [2]

- b) Find the value of  $e$  in the diagram below. The diagram is not drawn to scale.



Answer :  $e =$  \_\_\_\_\_ [4]

6) The product of my children's ages is 1408. The youngest is half as old as the eldest. How many children do I have?

Answer : \_\_\_\_\_ [3]

7) Edward can wash his car 3 times as fast as his son Matt. Working together, they can wash 30 cars in 6 hours. How many hours would it take Edward if his son wouldn't help?

Answer: \_\_\_\_\_ hours [3]

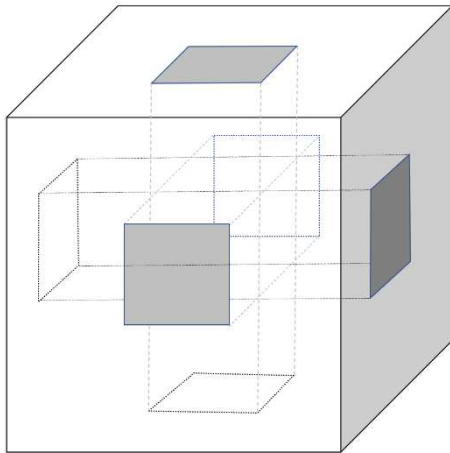
8) When 4 is added to two numbers their ratio is 5:6.

When 4 is subtracted from the numbers their ratio is 1:2.

What are the two numbers?

Answer : The numbers are \_\_\_\_\_ and \_\_\_\_\_ [5]

9) A cube of side 3cm has a 1 cm square hole punched out from the middle of each side.



Not drawn to scale

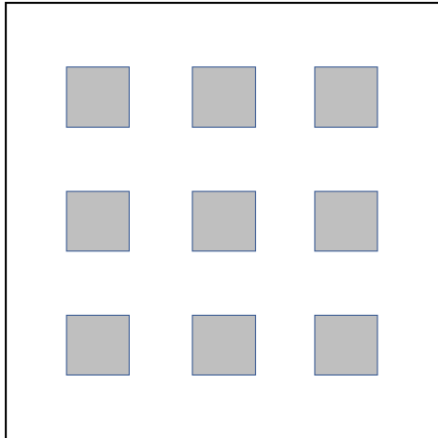
a) What is the volume of the remaining solid?

Answer a): \_\_\_\_\_  $\text{cm}^3$  [2]

b) What is the total surface area of the solid?

Answer b): \_\_\_\_\_  $\text{cm}^2$  [4]

- c) Another cube has side 7cm with nine 1cm x 1cm square holes drilled through each face as shown in the diagram below.



What is the volume of the solid remaining?

Answer c): \_\_\_\_\_ cm<sup>3</sup> [3]

10) A property owner has two houses for sale – one 2-bedroom house in a fashionable area (called Costalot), one 4-bedroom house in a less fashionable area (called Ifihafto).

They manage to sell them for £390 000 each.

Based on what they originally paid for them, Costalot has made them a profit of 20% whilst Ifihafto made them a loss of 20%.

a) What was the profit they made on Costalot?

Answer: Profit was £\_\_\_\_\_ [3]

b) What was the loss they made on Ifihafto?

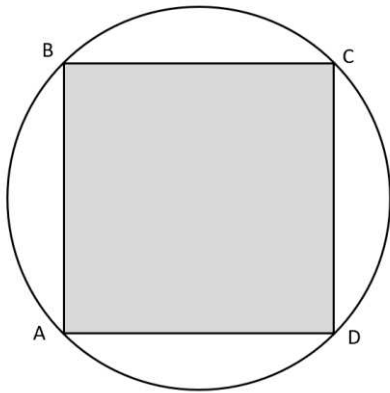
Answer: Loss was £\_\_\_\_\_ [3]

c) Did they make an overall profit, loss or break even on the two houses together and if a profit or loss, by what percentage?

Answer: \_\_\_\_\_ [2]

11) A square ABCD is inscribed to a circle radius 1 as shown.

What fraction of the circle's area is shaded grey?



Answer: \_\_\_\_\_ [6]

12) Joel took a train from Oxford to Reading, 26 miles away. The train usually travels at an average speed of 68 miles per hour.

a) How long does it take Joel to get to Reading in minutes?

Answer: \_\_\_\_\_ minutes [2]

b) Because there are works on the track the train is only allowed to travel at  $\frac{1}{3}$  of its usual speed. What is the average speed for Joel's entire journey to Reading and back to Oxford?

Answer: \_\_\_\_\_ miles per hour [4]

13) Answer this question on the graph paper below.

a) Draw and clearly label the lines on the axes below

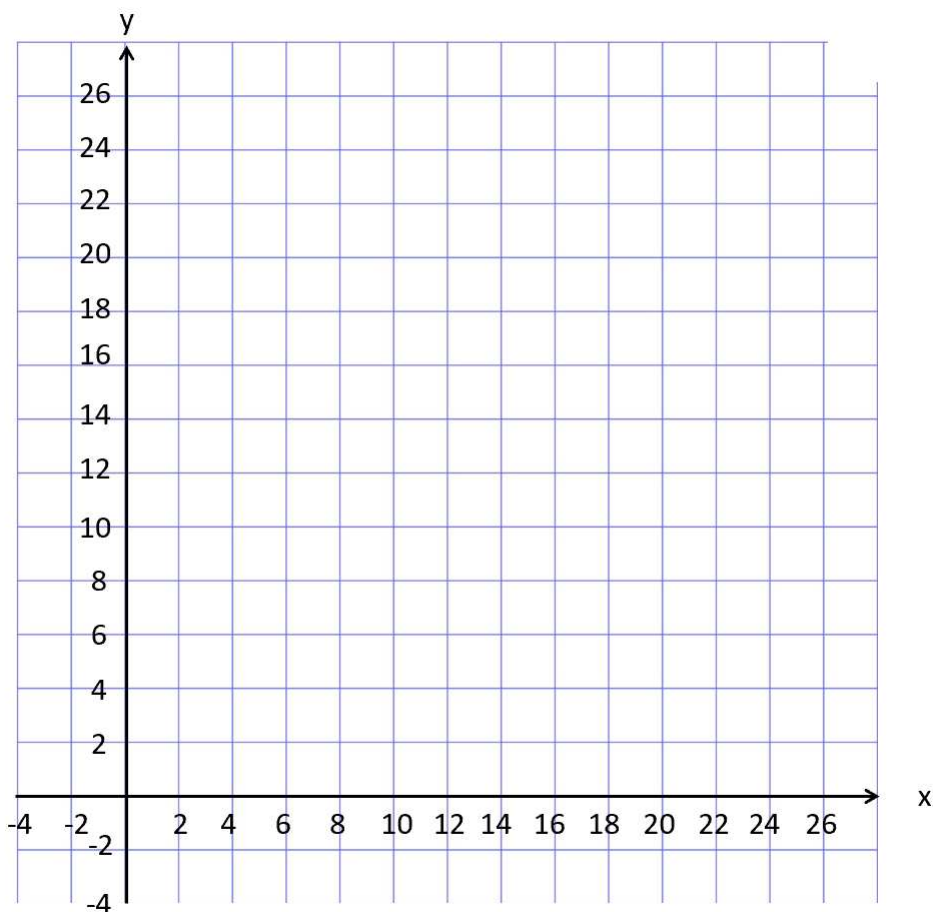
$$x = 4$$

$$x = 12$$

$$y = \frac{1}{2}x$$

$$y = \frac{1}{2}x + 15$$

Find the area of the quadrilateral that these lines form.



Answer: Area = \_\_\_\_\_ units<sup>2</sup> [7]

14) In the diagram is a square with sides of length 18cm. There is a small circle radius 2cm which is randomly positioned so that its centre lies inside the square.

Calculate the probability that the circle has some of its area outside the square. Express the answer as a simplified fraction.

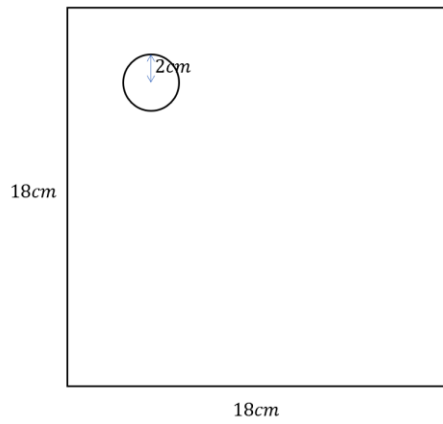


Diagram not drawn to scale

Answer: Probability = \_\_\_\_\_ [3]

15) A painter has 22 litres of grey paint made of 20% black (and 80% white) paint, called '20% grey'. He needs to paint a house with 50% grey. He also has some tins of 70% grey. How much of the 70% grey will he need to add to the 22 litres of 20% grey to get the 50% grey he needs?

Answer: \_\_\_\_\_ Litres [3]

16) We define  $n!$  to be the product of all the integers between 1 and  $n$  inclusive.

So, for example,  $5! = 5 \times 4 \times 3 \times 2 \times 1 = 120$

$5!$  is a multiple of 10 and has one zero at the end.

How many zeros will be at the end of the following, explaining your reasoning

a) 20!

Answer: a) = \_\_\_\_\_ [2]

b) 36!

Answer: b) = \_\_\_\_\_ [2]

c) 200!

Answer: c) = \_\_\_\_\_ [4]

**END OF TEST**