Admissions Test

Specimen Paper

1½ hours

This admissions test is designed to assess your mathematical thinking.

All questions require no more than the content of GCSE mathematics, but they may not be of the style you are accustomed to.

You may find some of the questions challenging. As schools teach the GCSE mathematics content in different order, there may be a small number of questions that you have not yet covered in your maths lessons. You may be able to work out how to do these questions anyway.

Remember that if you find something challenging, it is likely that others are finding it similarly challenging.

Consider carefully how to distribute your time across the three sections.

Instructions to candidates

Answer **all** questions.

You may **not** use a calculator.

Enter your answers in the appropriate spaces in the answer booklet.

If you run out of space, you may ask for additional paper.

There are three sections.

Section A is worth 20 marks. It consists of 10 multiple choice questions which test your understanding of GCSE Mathematics content.

Section B is worth 20 marks. It consists of 10 multiple choice questions which test your reasoning and thinking skills.

If you change your mind about the answer to a multiple choice question, make it clear which answer you are choosing.

Section C is worth 20 marks. It consists of 3 questions which test presentation of mathematical arguments and problem solving. You should show full working and reasoning for section C.

If you require more space for working, you may ask for additional paper. The question numbers and your name must be written on any additional paper.

Total: 60 marks

Each question is worth 2 marks.

Put a circle around the one correct answer in the answer booklet. If you change your mind about an answer, make it clear which answer you are choosing.

1 p is a positive number.

Which is larger: $p\%$ of 25 or 25% of p?

A They are both the same.

B They are both the same as long as p is no bigger than 100.

C $p\%$ of 25

D 25% of p

E It depends on the value of p

2 One of the following statements is **false**. Which one?
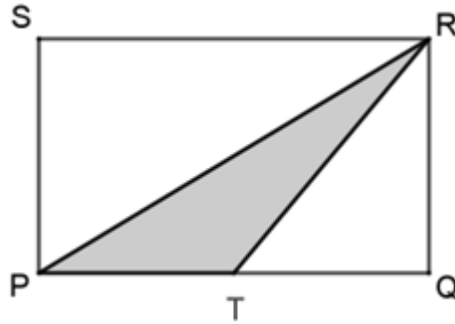
A $a^5b^2 \times a^{-2}b^{-2} = a^3$

B $(4a^4b^{-1})^3 = 64a^{12}b^{-3}$

C $\dfrac{12ab^5}{8a^4} = 1.5a^{-4}b^5$

D $10ab^2 - 2b^2a = 8ab^2$

E $\dfrac{18}{a^{-6}} = 18a^6$

3 PQRS is a rectangle.

T is the midpoint of PQ.

What is the ratio of the area of triangle PTR to the area of rectangle PQRS?

A It depends on the size of the rectangle

B $1:2$

C $1:3$

D $1:4$

E $1:5$

4 m and n are positive integers.

What is the greatest integer that will always be a factor of $660m + 8400n$?

A 5   **B** 20   **C** 30   **D** 60   **E** 92 400

5 A sequence has n^{th} term given by the formula $n^2 + 2n - 3$.

n takes values from 1 onwards.

Which of the following statements is true?

A There are no prime numbers in the sequence.

B There is exactly one prime number in the sequence.

C There is at least one prime number in the sequence but it is not possible to tell whether there are others.

D There is more than one prime number in the sequence but not infinitely many.

E There are infinitely many prime numbers in the sequence.

6 A solid cylinder has total surface area A, volume V and radius r.

Which of the following is a correct formula for A?

A $A = 2\pi r^2$

B $A = \dfrac{V}{2r}$

C $A = \dfrac{2V}{\pi r} + 2\pi r^2$

D $A = \dfrac{V}{r} + 2\pi r^2$

E $A = \dfrac{2V}{r} + 2\pi r^2$

7 There are 9 buses at the bus station.

The mean number of people on a bus is exactly 25.

Another bus arrives. No people or buses leave.

Is it possible that the mean number of people on a bus will now be 22?

A Yes.

B The mean couldn't be exactly 22, but it could round to 22.

C No, the mean has to be bigger than 22.

D No, the mean has to be smaller than 22.

E No, the mean has to be odd.

8 $a = 3x + 5, \quad b = 3x + 10, \quad c = 5x + 10.$

Which one of the following statements is true?

A Both b and c are greater than a for all values of x.

B c is less than $2a$ for all values of x.

C Depending on the value of x, any of a, b or c could be the greatest.

D c is the greatest for all values of x.

E b is greater than a for all values of x and there are some values of x for which a is greater than c.

9   A 5p coin is circular with diameter 18 mm.

The coin is placed so that it lies within a square of side 2 cm.

What is the area, in mm², of the region where the centre of the coin could be?

A 1   **B** 2   **C** π **D** 4   **E** 2π

10   The graph of a quadratic function crosses the axes at points P, Q and R given below.

P(-4, 0), Q(0, -24), R(2, 0)

What are the coordinates of the turning point of the graph?

A (-1, -27)

B (0, -24)

C (-1, -9)

D (-2, -24)

E (-2, -27)

Section B starts on the next page.

Section B

20 marks

Answer all questions

Each question is worth 2 marks.

Put a circle around the one correct answer in the answer booklet. If you change your mind about an answer, make it clear which answer you are choosing.

11 Each point in the scatter graph below represents a country in Europe.

The graph shows the median age of people in the country and the number of mobile phones per 100 people.
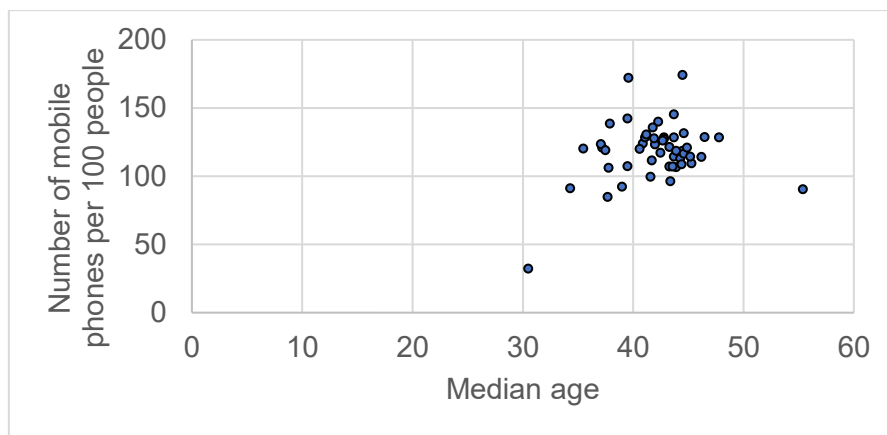
Which of the following is a reasonable conclusion to draw from the data?

A On average, people in Europe have one mobile phone each.

B Having a mobile phone makes you live longer.

C There is a country in Europe where more than half the population are over 50.

D Younger people are more likely to have a mobile phone than older people.

E Older people are more likely to have a mobile phone than younger people.

12 Jason goes for a run. He measures the distance as 1780 m and the time as 15 minutes.

The distance is measured to the nearest 10 m.

The time is measured to the nearest minute.

Assume that Jason runs at a constant speed.

Which calculation gives Jason's greatest possible speed for this run, in m s^{-1}?

A $1775 \div 900$

B $1775 \div 930$

C $1780 \div 15$

D $1785 \div 870$

E $1785 \div 930$

13 The pentathlon is a sporting competition which includes 5 sports.

This question is about a scoring system which has been used for one of the sports.

For swimming, there is a target time of 2 minutes 30 seconds for men and 2 minutes 40 seconds for women.

Swimmers start with a score of 1000 points.

- Each one third of a second above the target time results in 4 points subtracted.
- Each one third of a second below the target time results in 4 points added.

Forty points are subtracted for each of the following:

- a false start,
- failing to touch the wall at the end of a lap, or
- leaving the pool in an incorrect manner.

Which of the following is a possible score for the swimming in the pentathlon? The pentathlon is a sporting competition which includes 5 sports.

A 850   **B** 874   **C** 930   **D** 984   **E** 1074

14 The table shows the average price of a litre of diesel at the start of each year.

The prices have been rounded to the nearest penny.

Year	Price (p)
2010	111
2011	129
2012	141
2013	140
2014	138
2015	118

When was the largest percentage change in average price?

A 2010 to 2011

B 2011 to 2012

C 2012 to 2013

D 2013 to 2014

E 2014 to 2015

15 Three fair coins are tossed.

Which of these three events is the most likely?

- Exactly one head
- Exactly two heads
- Exactly three heads

A Exactly one head

B Exactly two heads

C Exactly three heads

D They are all equally likely

E Two of the three events are equally likely

16 Enid is knitting jumpers and scarves to sell.

Each jumper uses 7 balls of wool. Each scarf uses 3 balls of wool.

Enid has 52 balls of wool. She wants to use all of the wool.

Enid wonders how many jumpers and scarves she can make.

How many possible answers are there?

A 4 **B** 3 **C** 2 **D** 1 **E** 0

17 Jake is buying 12 identical items from a website.

He has three special offer codes he can use. He can only use one of the codes.

1FREE	**25OFF**	**HALF**
Every time you buy two items, you can have a third item free.	25% off the cost of your order.	Every time you buy one item, you can have a second item half price.

Which code will give Jake the overall lowest price for his order?

A 1FREE

B 25OFF

C HALF

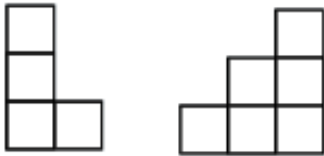**D** There are two offers which give the lowest price.

E It depends on the cost of the item he is buying.

18 A solid shape is made from identical cubes.

The cubes are joined with the face of one cube coinciding with the face of the joining cube.

The shape stands on a flat surface.

Two side views of the shape from different viewpoints are shown below.

What are the minimum and maximum possible number of cubes used to make the shape?

A	
Min	Max
4	6

B	
Min	Max
6	9

C	
Min	Max
7	9

D	
Min	Max
6	10

E	
Min	Max
7	10

19 The table below shows the percentage of salt in two powders.

	Powder X	Powder Y
Percentage of salt	59	89

A scientist wants a powder with 77% salt.

The scientist will take some of powder X and mix it with some of powder Y.

What percentage of the mixture should come from powder X?

A 40%

B 50%

C 60%

D It depends on the amount of mixture.

E It is not possible.

20 A page from a calendar is shown below.

Mon	Tues	Weds	Thur	Fri	Sat	Sun
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

A class of students is investigating number squares on the calendar.

An example square is shown.

They multiply the numbers from opposite corners of the square. For the example square they would do $2 \times 18 = 36$ and $4 \times 16 = 64$.

Then they subtract the smaller product from the larger product to give the answer: $64 - 36 = 28$.

The squares can be any size but must have at least 4 numbers in them and there must be a number in each corner.

How many different correct answers can they get?

A 2 **B** 3 **C** 4 **D** 5 **E** More than 5

Section C starts on the next page.

It is important to show full working in this section. Write your full answers to each question in the answer booklet.

Mark allocations are shown in square brackets [ ].

21 You are given that $x + \dfrac{1}{x} = 3$.
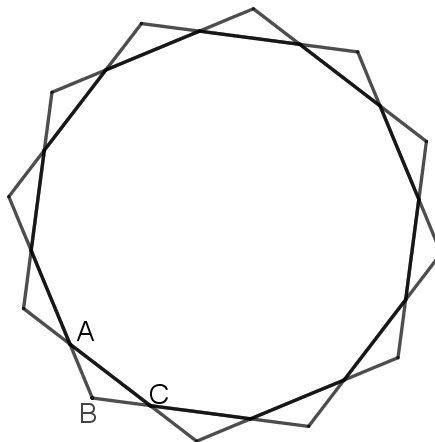
Find the value of $x^2 + \dfrac{1}{x^2}$.

[4]

22 A regular 12-sided polygon has sides of length 2 cm.

AC is one of the sides of the polygon.

Each side of the polygon is extended, as shown in the diagram, to add a triangle onto each side of the polygon making a 12-pointed star.

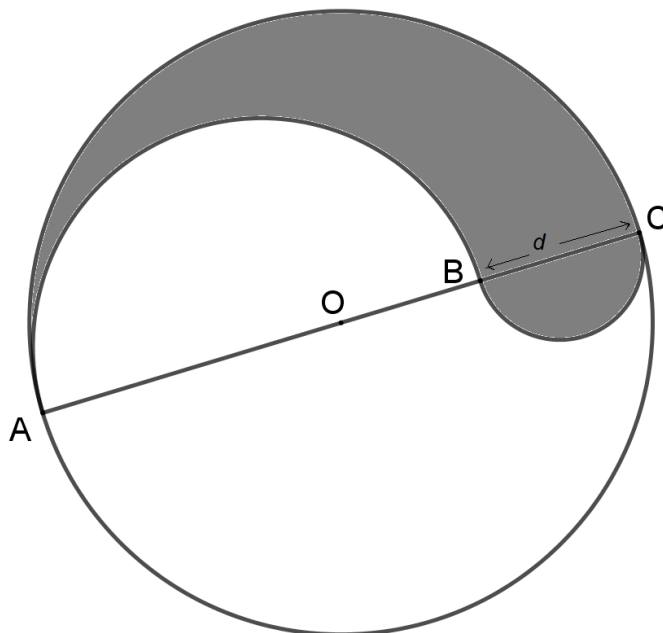Find the exact length of AB, one of the sides of the 12-pointed star.

[6]

23 A circle has centre O. AC is a diameter with length D cm.

A point B lies on AC with BC = d cm.

Semicircles with diameter BC and AB are drawn, as shown in the diagram, and a region is shaded.

(a) Show that the perimeter of the shaded region is equal to the circumference of the circle with diameter AC.

[3]

(b) Show that the fraction of the circle with diameter AC that is shaded is $\dfrac{d}{D}$.

[7]

End of test.