Mathematics Entrance Examination

10 July 2019

1. **You have 1 hour and 10 minutes for the exam.**

2. **Answer all questions.**

3. **No calculators are allowed.**

4. **Write your answers in the spaces below the questions. Answers with no evidence of calculations will not score any marks. Workings and answers written on any other page will not be marked.**

Please note additional requirements:

a) You are not allowed to leave during the first 30 minutes or the last 15 minutes of the examination.

b) If you are left handed or ambidextrous with left hand preference you should inform the invigilator before the start of the exam so that seating arrangements can fit your requirements.

c) You are not allowed to talk, to whisper, to turn around or to look at another candidate's examination, all of which are offences and you will be penalized. If you commit this offence you will be given a single written warning; after which if you commit a further offence, you will be reported to an assessment board without a right of appeal or refund of the exam administration fee.

d) No scrap paper may be used. All work must be written in the exam booklet.

e) You can use non-erasable blue or black pen only. Any answers written in pencil may not be marked.

f) You cannot use whiteout/correction fluid. If you use this material to correct any of your answers they may not be marked. If you make a mistake, you should simply draw a line through the mistake with pen and continue.

g) You cannot borrow another student's stationery or materials.

h) If your pen runs out of ink, you may request a replacement from the invigilator. No other stationery or materials may be provided for you by the invigilator.

i) If you are found to have any unauthorized exam related materials during the examination this will constitute an offence and you will be disqualified from the exam without a right to claim the reimbursement of the exam administration fee.

j) If you are caught cheating in the examination, you will be disqualified from the exam without a right to claim the reimbursement of the exam administration fee.

k) Failure to show contents of your pockets or any other containers to the invigilators will be considered as an offence and you will be disqualified from the exam with no right of appeal or refund of the fee.

l) All mobile phones and other electronic devices must be switched off and left at a place indicated by the invigilators. If you are found to have a mobile phone or other electronic device (switched on or off) on you during the exam, this will be considered as unauthorised examination materials and you will be disqualified from the exam without a right of appeal or refund of the fee.
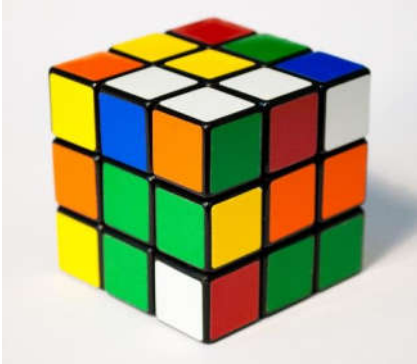
Applicant ID:

All questions on this paper must be answered.

Write the answers in the space below each question.

Show **ALL** working for each question.

Q 1.

a) In a Rubik's cube what is the ratio of individual cubes which have 3 coloured sides, two coloured sides and one coloured side?

Express your ratio in its simplest form

....

(4 marks)

b) How many cubes have no coloured sides?

....

(1 mark)

Total marks for page: 5 marks

Q 2.

   a) A wheel has a diameter of 60 cm.

Its circumference is _estimated_ at 3 x 60.

Find the percentage error.   (Use $\frac{22}{7}$ as the value of π)

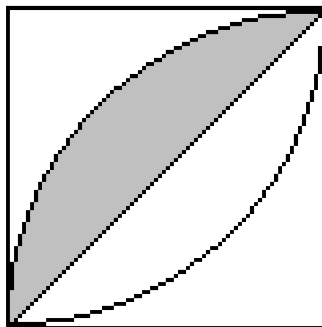Give your answer to 1 decimal place.

……………………………..

(5 marks)

   b) The square below has sides of 10 cm long.

The arcs have centres at the corners.

Using 3 as the value of π, calculate the percentage of the square which is shaded.

……………………………………………..

(3 marks)

Total marks for page: 8 marks

Q 3.

a) Find three pairs of parallel vectors from those below

a + 3b	a – b	6a – 3b	2a + 6b	3a – 3b	2a – b	a + b
A	B	C	D	E	F	G

Pair 1…………………………………………………….(1 mark)

Pair 2……………………………..………………………….(1 mark).

Pair 3……………………….……………….……………….(1 mark)

b) i. Find the single vector with no pair.

ii. Give the vector which has the opposite direction and a magnitude of 2.

…………………………

(2 marks)

Total marks for page: 5 marks

Q 4.

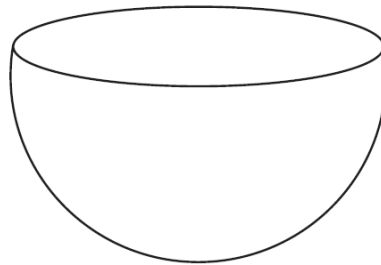Work out

$$\frac{0.006 \times 0.0003}{0.009}$$

Give your answer in standard form.

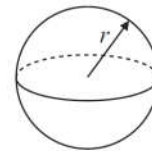.............................

(3 marks)

Q 5.

Not drawn to scale

Volume of sphere $= \frac{4}{3}\pi r^3$

Surface area of sphere $= 4\pi r^2$

The diagram shows a solid hemisphere.

The volume of the hemisphere is $\frac{250}{3}\pi$

Work out the exact total surface area of the solid hemisphere.

Give your answer as a multiple of π

....

(4 marks)

Total marks for page: 7 Marks

Q 6.On the grid opposite draw and label the following graphs

    a) $2x + 5y > 17$ 2 marks

    b) $x + y < 10$ 2 marks

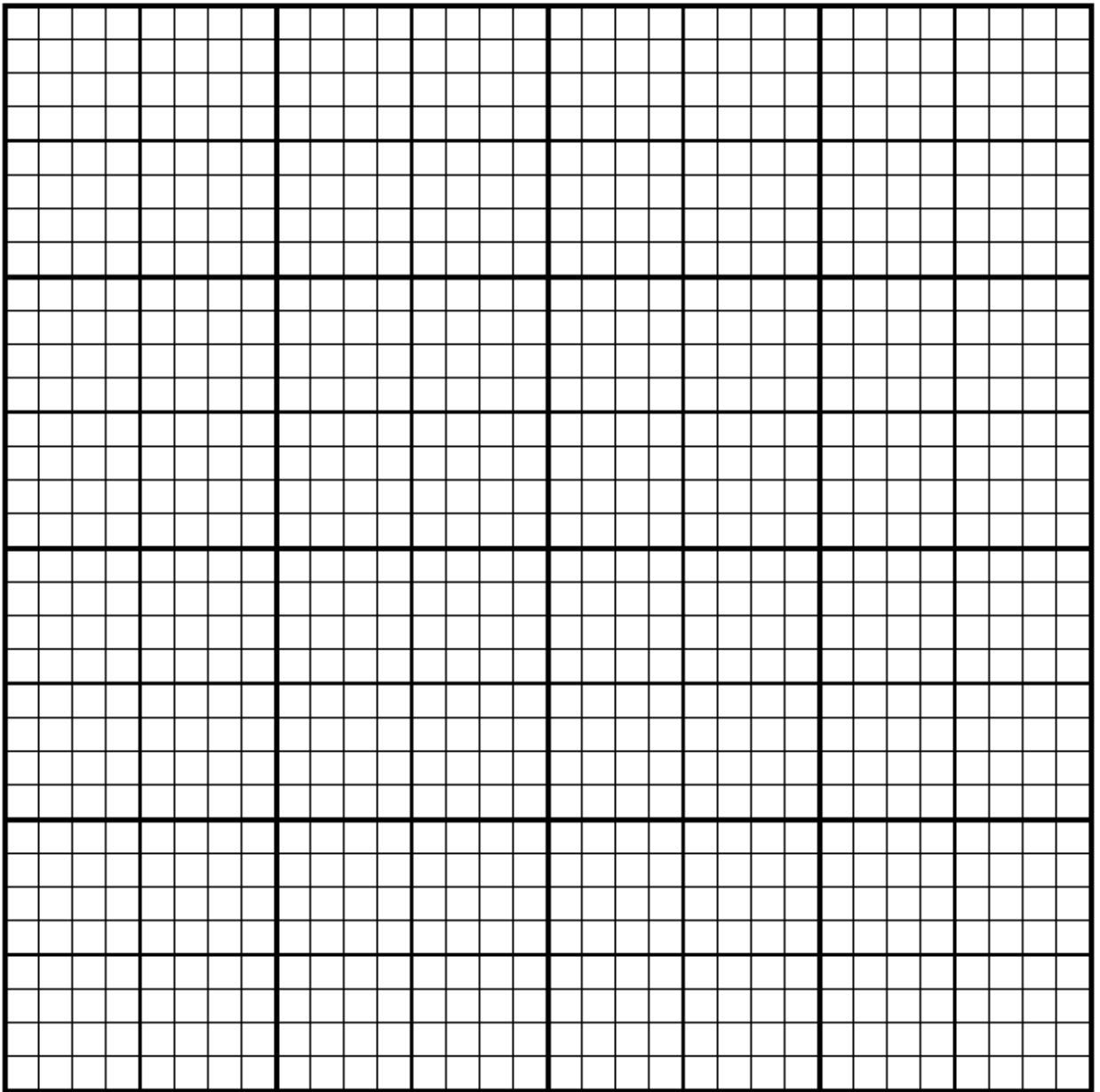   c) $y - 2x < 1$ 2 marks

    d) Clearly shade the area which is bounded by all three lines

                                                                   2 marks

        (Processes of how to get sketches of graph MUST be shown.)

Q 7.

a) Calculate the *perimeter* of the picture in terms of x

Give your answer in its simplest form

Height

$2(x + 1)$

Width $(x + 7)$

....

(2 marks)

b) If $x = 30$ cm what is the area of the picture?

....

(2 marks)
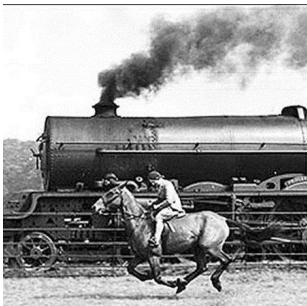
(Total marks for page: 4 marks)

Q 8.

The size of each interior angle in a regular polygon is 11 times the size of each exterior angle of that polygon.
Calculate how many sides the polygon has.

………………………..

(2 marks)

Q 9. A train of length 100 m is moving at a speed of 50 km/h.

A horse is overtaking the train at a speed of 56 km/h.

How long will it take for the horse to fully overtake the train?

…………………………

(3 marks)

Total marks for page: 6 marks

Q 10.

a) Simplify

$$\frac{x^2 + 7x + 10}{x^2 - 4}$$

....

(2 marks)

b) Make x the subject of the formula

$$e + \sqrt{(x + f)} = g$$

....

(2 marks)

c) Solve

$$(2x - 10)(x - 3) = (2x - 3)(x - 1)$$

....

(2 marks)

Total marks for page: 6 marks

Q 11.

    a) Solve the following simultaneous equations

$$5x - 7y = 27$$

$$3x - 4y = 16$$

$x =$ ……………………………

$y =$ ……………………………

(4 marks)

b) Given that $a = \dfrac{3}{4}$, $b = \dfrac{2}{5}$ and $c = \dfrac{1}{3}$, calculate (express your answers in the simplest terms)

i) abc

……………………………(2 marks)

ii) $2b - c$

………………………(3 marks)

Total marks for page: 9 marks

Q 12.

A box has a square base of side 30 cm and height of 20 cm.

Calculate the increase in the volume of the box after the length and width of the

base are both increased by 10% and the height is increased by 5%.

20 cm

← 30 cm →

....

(3 marks)

Total marks for page: 4 marks

Q 13.

a) The sum of *three consecutive square* numbers is 194.
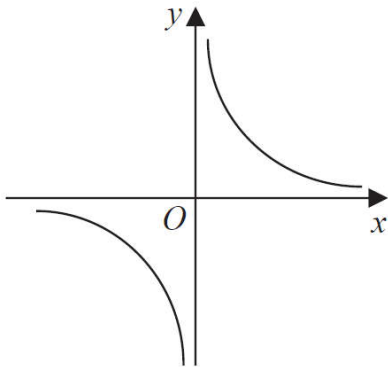Find the three square numbers.

……………………………………..
(2 marks)

d) The sum of the cubes of *three consecutive whole* numbers is 99.
   Find the three consecutive numbers.
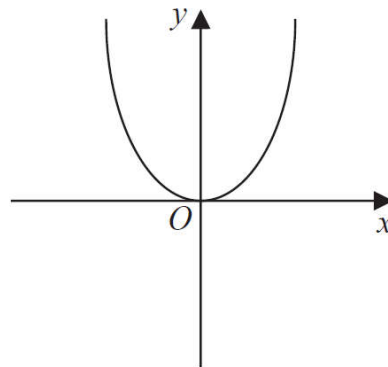
…………………………………
(3 marks)

Total marks for page: 5 marks
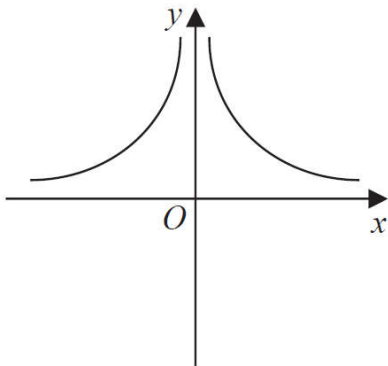
14. These graphs show four different relationships between *x* and *y*.

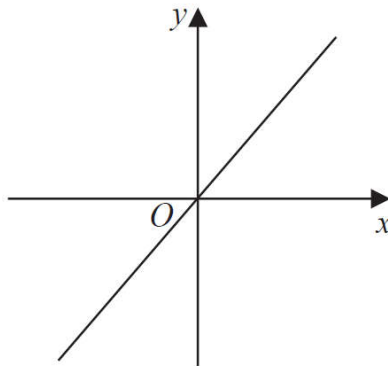Match each graph with one of the statements in the box below.

Graph A

Graph B

Graph C

Graph D

Proportionality relationship	Graph letter
y is directly proportional to *x*	
y is inversely proportional to *x*	
y is proportional to the square of *x*	
y is inversely proportional to the square of *x*	

(4 marks)

Total marks for page: 4 marks

END OF TEST
DO NOT WRITE ON THIS PAGE