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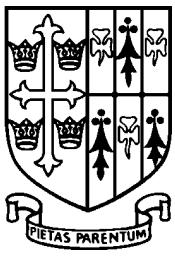


16+ ENTRANCE EXAMINATION

For entry in

September 2015

Mathematics

Time: 1 hour

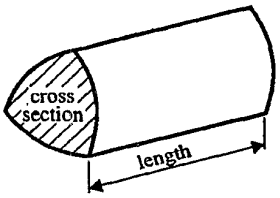
Candidates Name: ……

Instructions to Candidates

- 75 Marks
- Time allowed 1 Hour
- Calculators are allowed
- Write all answers, including your workings, in this booklet

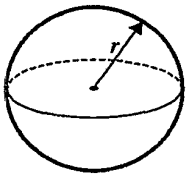
You may use the following formulae:

Volume of prism = area of cross section × length



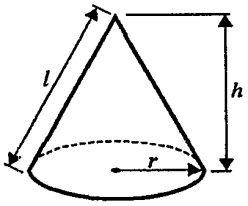
Volume of sphere = $\frac{4}{3}\pi r^3$

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



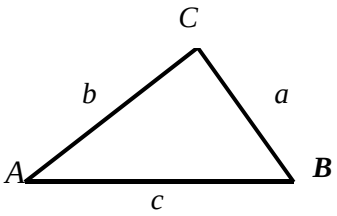
Volume of cone = $\frac{1}{3}\pi r^2 h$

Curved surface area of cone = πrl



In any triangle ABC

Sine Rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$



Cosine Rule $a^2 = b^2 + c^2 - 2bc\cos A$

Area of triangle = $\frac{1}{2}ab\sin C$

The Quadratic Equation

The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$, are given by $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

1. (a) Expand and simplify

$$6(3x - 2) - 4(2x - 3)$$

.....

(2)

(b) Factorise fully

$$30x^3y^2 + 12x^2y$$

.....

(1)

(c) Factorise $x^2 - 14x + 48$

.....

(2)

(c) Factorise $12x^2 - 16x - 3$

.....

(2)

(Total 7 marks)

2.

Make x the subject of the formula

$$\sqrt[3]{\frac{x+3}{x+d}} = b$$

.....

(Total marks 3)

3. a) $-2 < x \leq 1$

x is an integer.

Write down all the possible values of x.

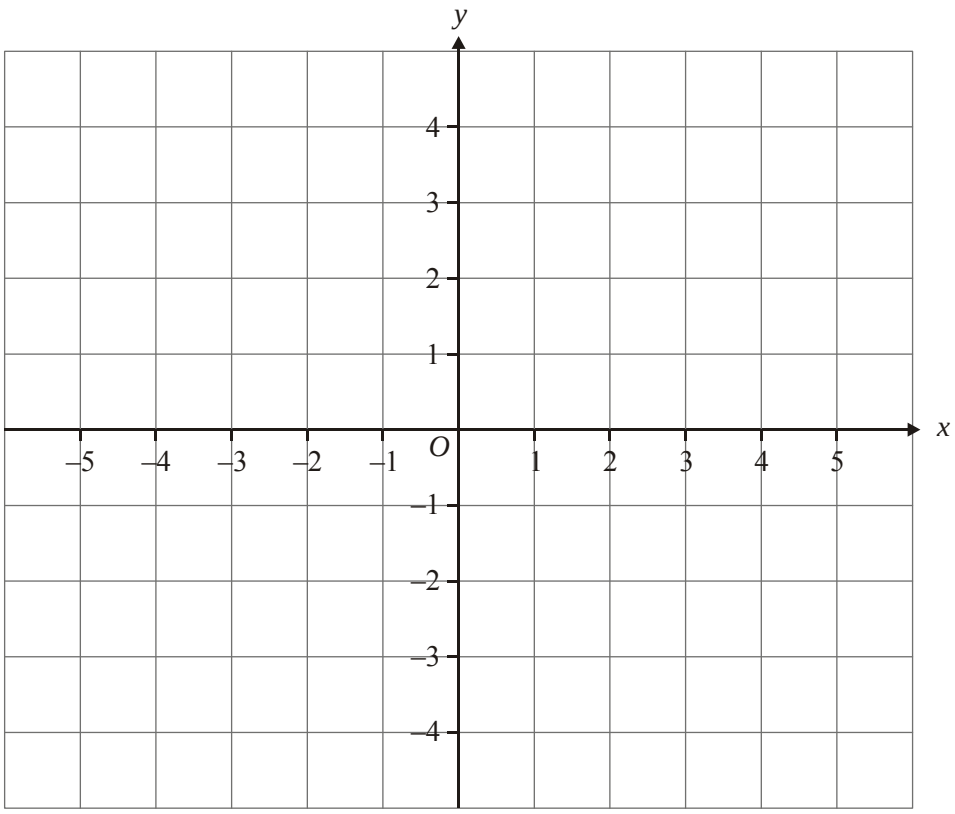
.....

(2)

(b) $-2 < x \leq 1$ $y > -2$ $y < x + 1$

x and y are integers.

On the grid, mark with a cross (✕), each of the six points which satisfies **all** these 3 inequalities.



(3)

(Total 5 marks)

4.

Keisha had 10 000 USD to invest. She invested *m* USD at the *Midland Bank*, which gave her 8% annual interest. She invested *f* USD at the *First National Bank*, which gave 6% annual interest. She received a total of 640 USD in interest at the end of the year.

(a) Write two equations that represent this information.

(b) Find the amount of money Keisha invested at each bank.

(Total 8 marks)

5.

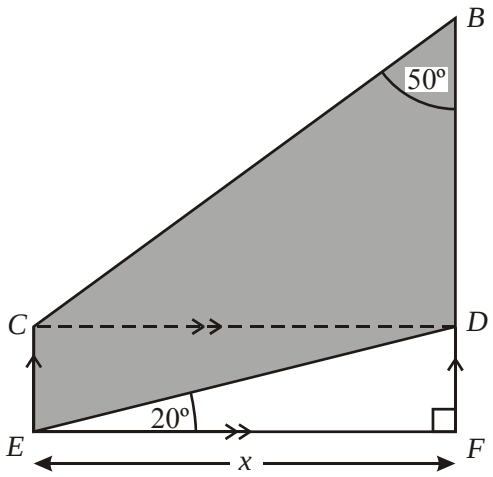


Diagram **NOT** accurately drawn

BCEF is a trapezium.
EC is parallel to *FDB*.
CD is parallel to *EF*.
Angle *CBD* = 50°. Angle *DEF* = 20°. Angle *EFD* = 90°.

EF = 15cm.

(a) Find,

(i) the length of *DF*,

…….

(ii) the area of triangle *DEF*.

……. **(3)**

(b) Work out the percentage of the trapezium *BCEF* that is **not** shaded.

……. %

(4)
(Total 7 marks)

6.

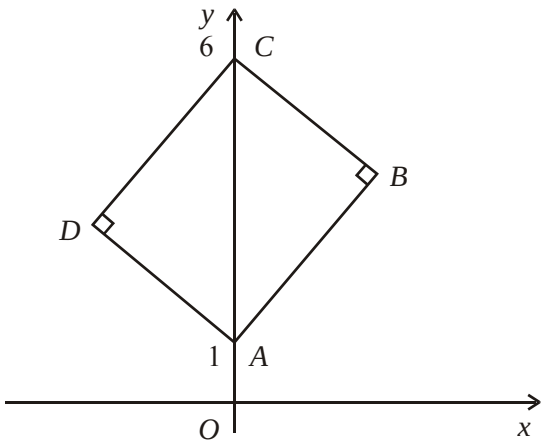


Diagram **NOT** accurately drawn

ABCD is a rectangle.
A is the point (0, 1).
C is the point (0, 6).

The equation of the straight line through *A* and *B* is $y = 2x + 1$

(a) Find the equation of the straight line through *D* and *C*.

.....

(2)

(b) Find the equation of the straight line through *B* and *C*.

.....

(2)

(Total 4 marks)

7. (*a*) What is $\left(\frac{a^2}{9}\right)^{\frac{-3}{2}}$

(3)

(*b*) Expand and simplify $(7 + \sqrt{5})(3 - \sqrt{5})$.

(3)

(c) Express $\frac{7+\sqrt{5}}{3+\sqrt{5}}$ in the form $a + b\sqrt{5}$, where a and b are integers.

(3)

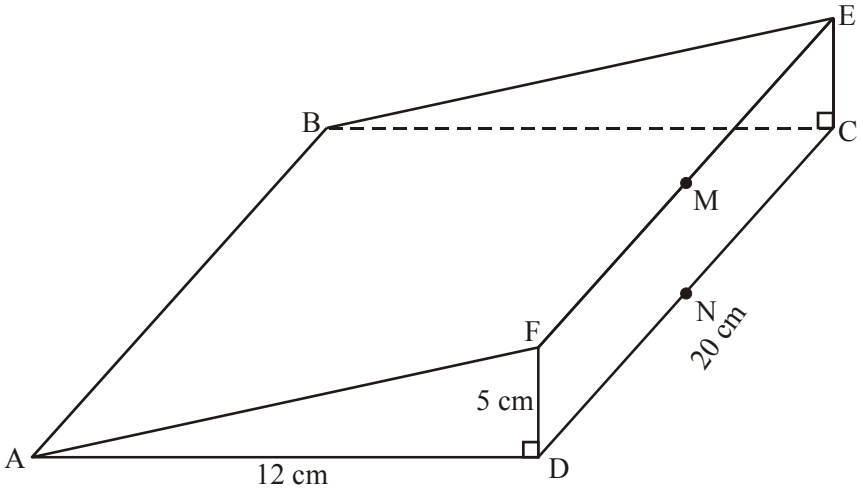
……

(3)

(Total 9 marks)

8.

In the diagram below ABEF, ABCD and CDFE are all rectangles. AD = 12 cm, DC = 20 cm and DF = 5 cm.
M is the midpoint of EF and N is the midpoint of CD.



(a) Calculate (i) the length of AF;

(ii) the length of AM.

(Total 5 marks)

9. a) Simplify fully

$$\frac{x^2+5x-6}{x^2-1} \div \frac{x+3}{x-1}$$

b) Simplify fully

$$\frac{(-4m^3)^3 \cdot (2m^2)^2}{(2m)^3 \cdot (4m^2)^2}$$

(Total 5 marks)

10. Solve the simultaneous equations

$$y - 3x + 2 = 0$$

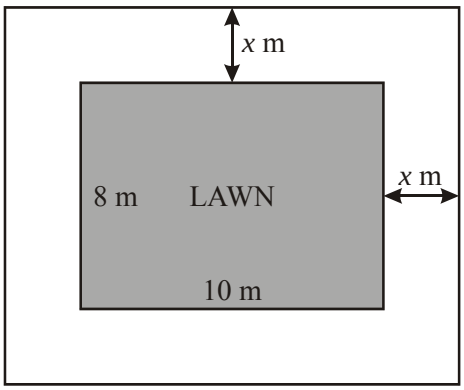
$$y^2 - x - 6x^2 = 0$$

……

[Total 7 marks]

11.

The diagram below shows a path x m wide around a rectangular lawn which measures 10 m by 8 m.



(a) Write down an expression in terms of x for the area of the path.

(b) What is the width of the path when its area is 208 m^2?

..... m^2

(Total 6 marks)

12.

1. **Solve this system of equations**.

   $m = 5n + 2$
   $3m – 7n = 6z$
   $4z – m = n$

.....

(Total 5 marks)

This question is a Challenge questions, and is intended to be difficult. Please only attempt it if you have finished questions 1 to 12.

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13. Of the numbers 1, 2, 3, . . . , 6000, how many are not multiples of 2, 3 or 5?

……..

[4]

END OF TEST