ST EDWARD'S

OXFORD

16+ ENTRANCE EXAMINATION

For entry in

September 2016

Mathematics

Time: 1 hour

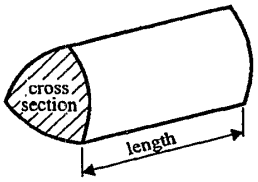
Candidates Name: ……

Instructions to Candidates

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

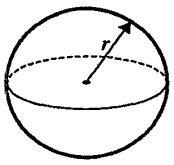
You may use the following formulae:

Volume of prism = area of cross section × length



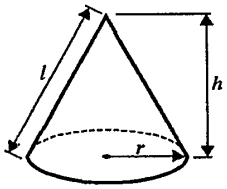
Volume of sphere = $\frac{4}{3}\pi r^3$

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



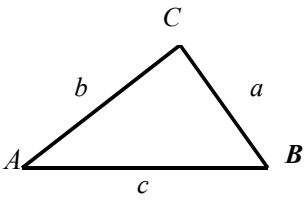
Volume of cone = $\frac{1}{3}\pi r^2 h$

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

$$5(2x - 1) - 3(2x - 5)$$

……

(2)

b) Factorise fully

$$36x^3y^2 + 45x^2y$$

……

(1)

c) Factorise $x^2 - 10x + 21$

……

(2)

d) Factorise $30x^2 - 19x - 5$

……

(2)

(Total 7 marks)

2) Simplify

a) $\left(x^{\frac{2}{3}}\right)^{\frac{-3}{2}}$

.....

(1)

b) $(64a^6)^{\frac{1}{2}}$

.....

(2)

c) $\frac{a^{\frac{3}{2}}}{b^3} \div \frac{a^{-1}}{b^2}$

.....

(2)

d) $\left(\frac{27c^3}{d^3}\right)^{\frac{-1}{3}}$

.....

(2)

3) Freddie cycles to work every day.

a. Yesterday, his journey home from work took 50% longer than usual. By what percentage was his average speed slower than normal?

……

(3)

b. By what percentage would he have to increase his speed in order to reduce the journey time by 20%?

……

(2)

4) A has coordinates (40,60)
B has coordinates (0,20)

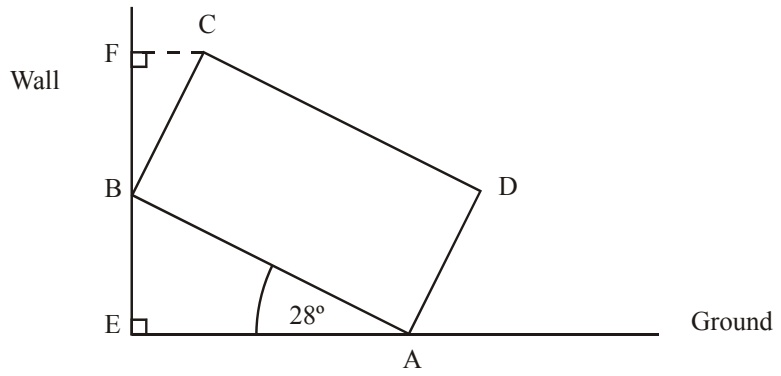
A straight line passes through the points A and B
The point P lies on this straight line.
The x coordinate of P is 0.5

Find the y coordinate of P

……

(2)

5) A rectangular block of wood with face ABCD leans against a vertical wall, as shown in the diagram below. AB = 8 cm, BC = 5 cm and angle $B\hat{A}E = 28°$.



Find the vertical height of C above the ground. (Total 4 marks)

.....

(4)

6) Write the following as single fractions:

a. $\frac{3}{a}+\frac{2}{3a}+\frac{2}{3}$

.....

(2)

b. $\frac{a}{b}+\frac{3}{a}-\frac{2}{3ab}$

.....

(2)

c. $\frac{1}{x}+\frac{1}{(x-1)}-\frac{1}{x^2}$

.....

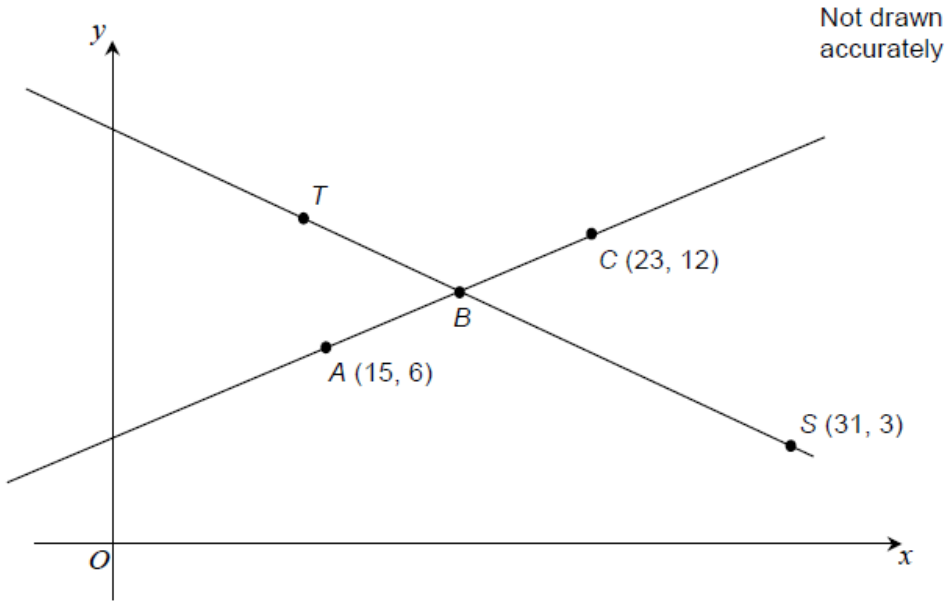
(2)

7)

Two straight lines are shown.

B is the midpoint of AC.

$TB : BS = 2 : 3$



Work out the coordinates of T.

.....

(3)

8) $(3+\sqrt{a})(4+\sqrt{a}) = 17 + k\sqrt{a}$

Find the value of a and the value of k

……

(3)

9) The line l_1 has equation $y = 3x + 2$ and the line l_2 has equation $3x + 2y - 8 = 0$.

(a) Find the gradient of the line l_2.

……

(2)

The point of intersection of l_1 and l_2 is P.

(b) Find the coordinates of P.

……

(3)

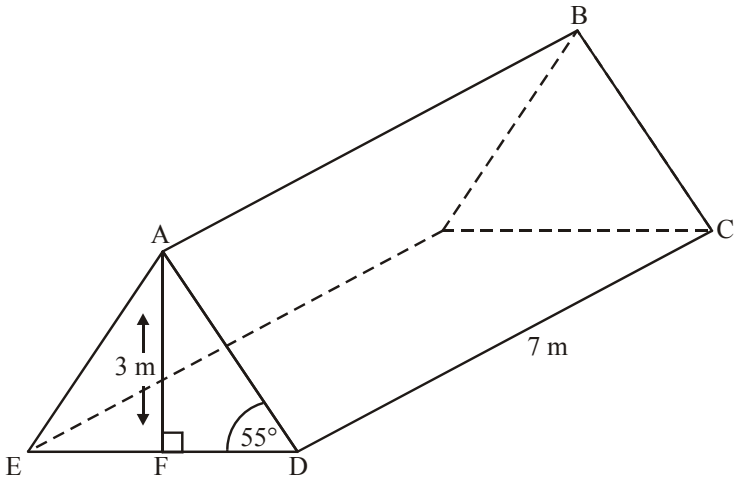
10) Make a the subject of the formula:

$$\boldsymbol{P = \sqrt{\frac{n^2 + a}{n + a}}}$$

……

(4)

11) The following diagram shows a sloping roof. The surface ABCD is a rectangle. The angle ADE is 55°. The vertical height, AF, of the roof is 3 m and the length DC is 7 m.



(a) Calculate AD.

……

(4)

(b) Calculate the length of the diagonal DB.

……

(4)

12) Solve the simultaneous equations

$$x + y = 2$$

$$x^2 + 2y = 12.$$

……

(6)

END OF TEST