# ST EDWARD'S

OXFORD

Lower Sixth Entrance Assessment

November 2013

Mathematics

1 hour

Candidate Name: ………………………………..

Instructions
- There are 80 marks available
- Write all answers, including your workings, in this booklet
- Calculators are allowed
- Where answers are not exact, they should be given to three significant figures unless otherwise specified

You may use the following formulae:

**Volume of prism** = area of cross section × length
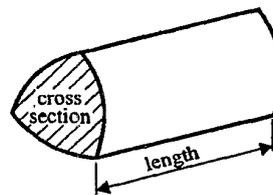
Volume of sphere = $\frac{4}{3}\pi r^3$

Surface area of sphere = $4\pi r^2$
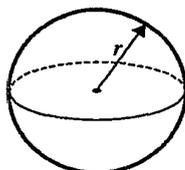
Volume of cone = $\frac{1}{3}\pi r^2 h$

Curved surface area of cone = $\pi r l$
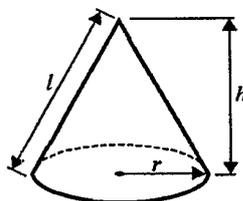
In any triangle ABC

Sine Rule $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$
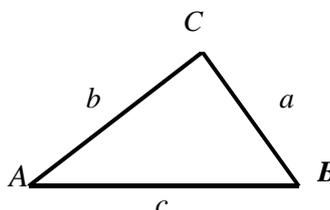
Cosine Rule $a^2 = b^2 + c^2 - 2bc \cos A$

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 $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

1. (a) Expand and simplify

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

……………………………

(2)

(b) Factorise

$$y^2 + y$$

……………………………

(1)

(c) Factorise $6x^2 - x - 2$

……………………………

(2)

(Total 5 marks)

2. (a)   Simplify $a^3 \times a^4$

.... **(1)**

(b)   Simplify $3x^2y \times 5xy^3$

.... **(2)**

(c)   Factorise $a^2 - 9b^2$

.... **(2)**

(d)   Factorise $x^2 + px + qx + pq$

.... **(2)**

(Total 7 marks)

3.

Make r the subject of the formula

$$P = \pi r + 2r + 2a$$

....

(Total marks 3)

4.
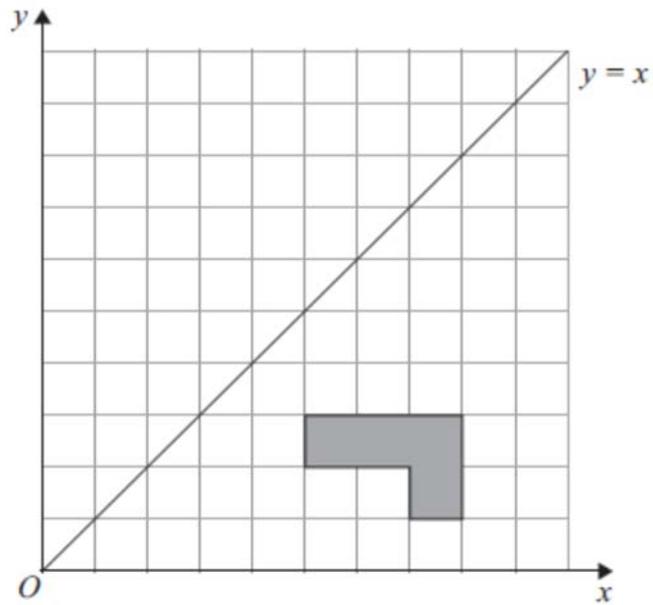
(a) Reflect the shaded shape in the line $y = x$.

(2)
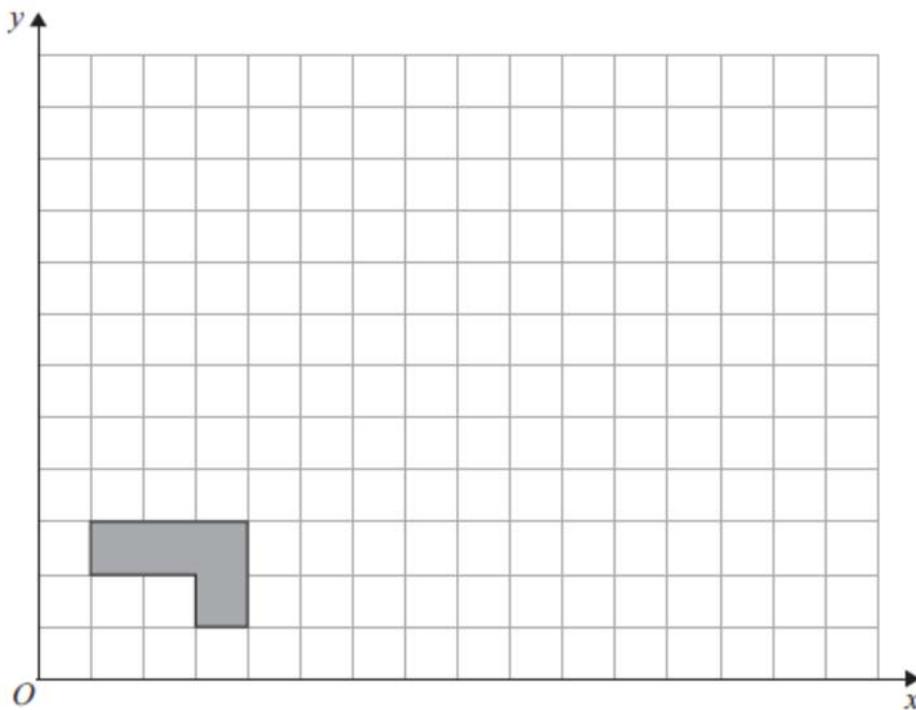
(b) On the grid, enlarge the shaded shape by a scale factor of 3, centre O.

(3)

(Total 5 marks)

5. $-3 < k \leq 2$

k is an integer.

(a) Write down all the possible values of k.

....

(2)

(b) Solve the inequality $\quad \dfrac{2x}{3} < 10$

....

(2)

(d) On the number line below, show the inequality $\quad -2 < y < 3$

(1)

(e) Here is an inequality, in x, shown on a number line.
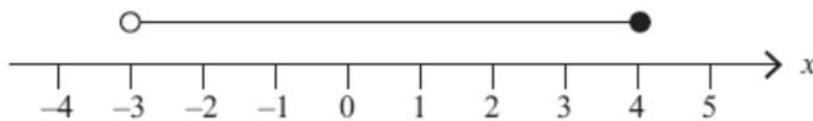
Write down the inequality.

....

(2)

(Total 7 marks)

6.

   **(a)**   In a sale the normal price of a book is reduced by 10%.
             The sale price of the book is £4.86
             Calculate the normal price of the book.

£..

(3)

    (b)   Lizzie bought a van.

           The total cost of the van was £6000 **plus** VAT at $17\frac{1}{2}$%.

£6000 PLUS VAT
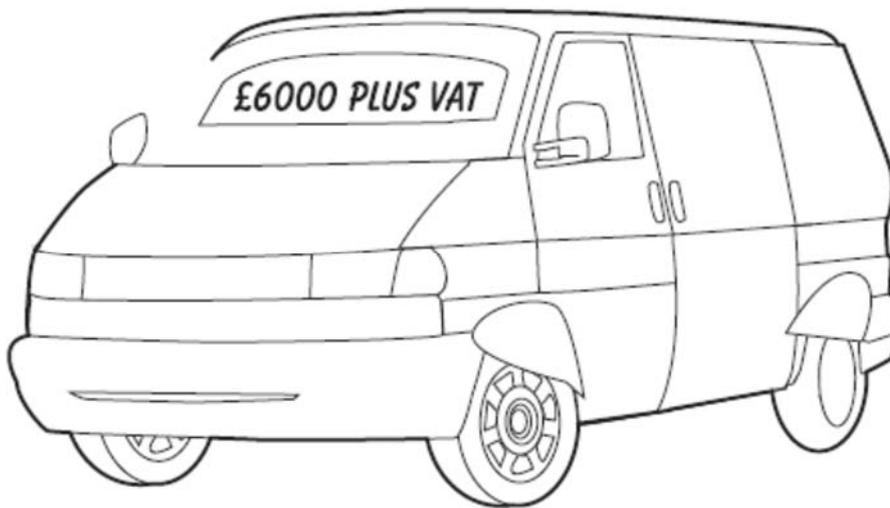
Lizzie paid £3000 when she got the van.

She paid the rest of the total cost of the van in 10 equal monthly payments.

Work out the amount of each monthly payment.

£ ....

(6)

(Total 9 marks)

7.
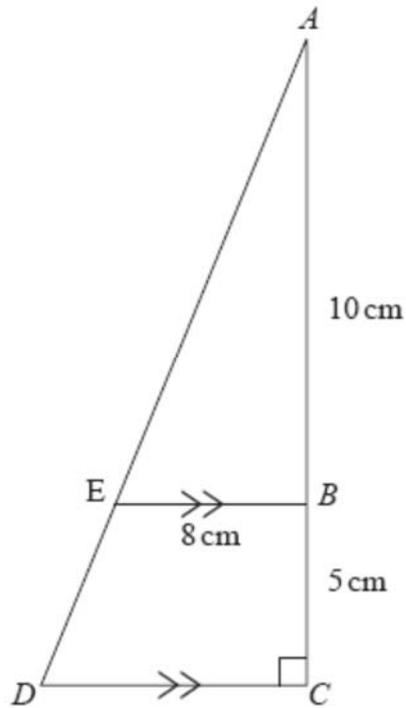
Diagram **NOT** accurately drawn

ABC and *AED* are straight lines. *EB* is parallel to *DC*. Angle *ACD* = 90°.

AB = 10 cm. *BC* = 5 cm. *EB* = 8 cm.

(a)   Work out the length of *DC*.

...............................cm

(2)

(b)   Work out the area of the trapezium *EBCD*.

...............................cm^2

(2)

(Total 4 marks)

8.
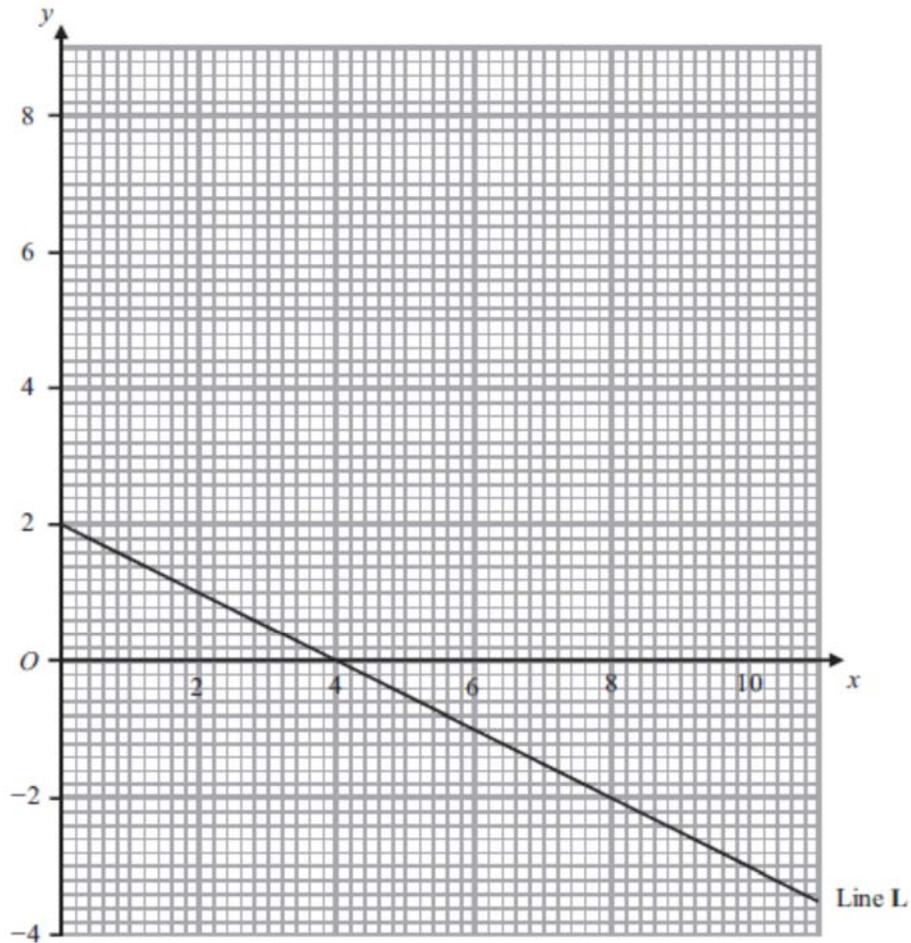
Line **L** is drawn on the grid.

(a) Work out the gradient of Line **L**.

....

(2)

Another line, Line **M**, is parallel to Line **L** and passes through the point (6, 2).

(b) Find an equation for Line **M**.

....

(2)

(Total 4 marks)

9. (*a*)   Show that $27^{-\frac{2}{3}} = \frac{1}{9}$

(3)

(*b*)   Given that $\dfrac{8 - \sqrt{18}}{\sqrt{2}} = a + b\sqrt{2}$, where *a* and *b* are integers,

find the value of *a* and the value of *b*.

a = ...

b = ...

(3)

(c)   Write as a single fraction in its simplest form $\dfrac{2}{x-4} - \dfrac{1}{x+3}$

....

(3)

(Total 8 marks)

10.

(a) Show that $\frac{2}{3} + \frac{1}{4} = \frac{11}{12}$.

....

(2)

(b) Show that $\frac{2}{5} \div \frac{3}{10} = 1\frac{1}{3}$

....

(3)

(Total 5 marks)

11.
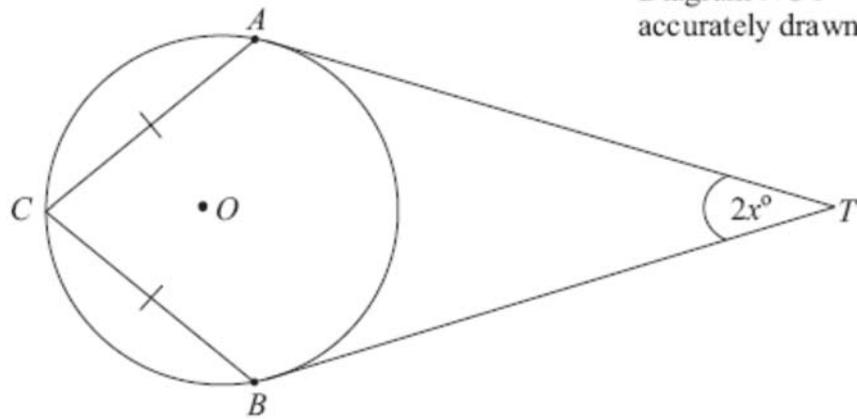
Diagram **NOT** accurately drawn

A, B and C are points on the circumference of the circle, centre O.

TA and TB are tangents to the circle.
CA = CB.
Angle ATB = $2x°$.
Show that angle ACB = $(90 - x)°$.

(Total 5 marks)

12. Solve the simultaneous equations

$$x + y = 2$$
$$4y^2 - x^2 = 11$$

....
[Total 7 marks]

$$x + y = 2$$
$$4y^2 - x^2 = 11$$

13.
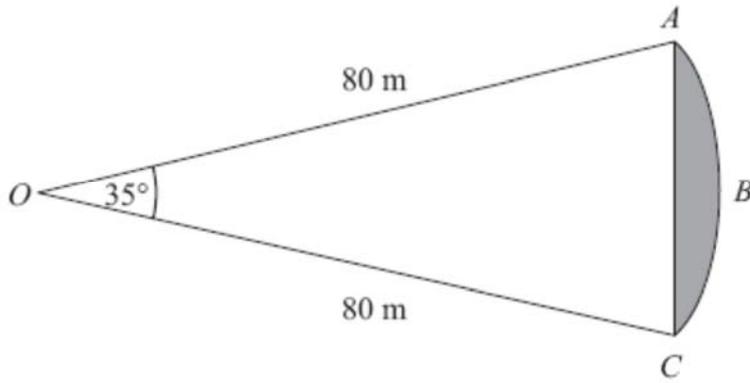
Diagram **NOT** accurately drawn

ABC is an arc of a circle centre *O* with radius 80 m.

AC is a chord of the circle.

Angle *AOC* = 35°.

Calculate the area of the shaded region.

Give your answer correct to 3 significant figures.

.... m^2

(Total 5 marks)

14.

Solve $\dfrac{5(2x+1)^2}{4x+5} = 5x - 1$

....

(Total 5 marks)

This question is from a UKMT Challenge paper, and is intended to be difficult. Please only attempt it if you have finished questions 1 to 14.

15. Two numbers x and y are such that $x + y = 20$ and $\dfrac{1}{x} + \dfrac{1}{y} = \dfrac{1}{2}$.

Showing full working, find the value of $x^2y + xy^2$.

....

[4]

END OF TEST