Wellingborough School
Founded 1595

# SAMPLE PAPER

# MATHEMATICS
# SCHOLARSHIP EXAMINATION 16+

**Candidate Number:**

**Time:** **1 hour (Non-Calculator)**

**Instructions to Candidates:**

- Attempt all questions
- Write all your answers in the spaces provided on this question paper
- Rough paper is NOT provided
- Calculators may **NOT** be used on this paper
- The number of marks for each part of each question is shown.
- This paper contains 12 questions.
- Maximum mark: 60

**Instructions to Invigilator:**

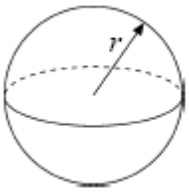
- Candidates will sit two one hour papers. Please collect this one in before handing out the Calculator paper.
- There is no reading time allowed.

**Some formulae you may need.**

**Do NOT write on this page – no credit will be given for anything on this page**

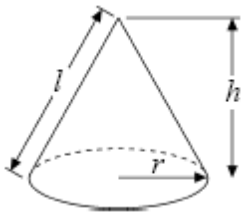
**Volume of sphere** $\frac{4}{3}\pi r^3$

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




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

**Curved surface area of cone** $= \pi r l$



1 Express the following number as products of their prime factors:

(a) 72

72 = ……..……(2)

(b) 80

80= ……..……(2)

(c) Two cars go round a race track. The first car takes 1 minute and 12 seconds to complete the circuit and the other car takes 1 minute 20 seconds.

They start together on the starting line.

Find the length of time, in minutes, before they are together again.

……..minutes (2)

**[Total 6 marks]**

2 Make x the subject of the formula

$$y = \frac{x^2 + 4}{5}$$

$x$ =……..……

**[Total 3 marks]**

3 Express the recurring decimal $0.2\dot{3}\dot{6}$ as a fraction in its lowest terms.

……..……

**[Total 3 marks]**

4 $\sqrt{12}$ can be written as $a\sqrt{b}$ where a and b are prime numbers.

Calculate the values of a and b.

a =……..……(1)

b =……..……(1)

(b) B = $\sqrt{12} + \sqrt{3}$

Show that $B^2 = 27$. Show your working

(2)

(c) $\frac{1}{\sqrt{12}}$ can be written in the form $2^{-1} \times 3^x$.

Find the value of x.

x =……..……(3)

**[Total 7 marks]**

5 (a) Evaluate $(5\frac{4}{9})^{-\frac{1}{2}}$

……..……(2)

(b) Find the value of d such that

$$\frac{1 + d}{d} = \sqrt{3}$$

giving your answer in the form $a + b\sqrt{3}$, where a and b can be fractions.

……..……(4)

**[Total 6 marks]**

6

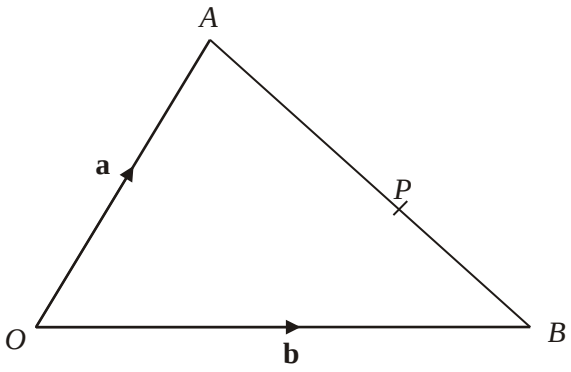



Diagram **NOT** accurately drawn

*OAB* is a triangle.

$\overrightarrow{OA}$ = **a**

$\overrightarrow{OB}$ = **b**

(a) Find the vector $\overrightarrow{AB}$ in terms of **a** and **b**.

$\overrightarrow{AB}$ = .....

(1)

*P* is the point on *AB* such that *AP* : *PB* = 3 : 2

(b) Show that $\overrightarrow{OP} = \frac{1}{5}(2\mathbf{a} + 3\mathbf{b})$

(3)

**[Total 4 marks]**

7 (a) Given that $y = 2^x$, find expressions in terms of y for

(i) $2^{x+2}$

……..……(2)

(ii) $2^{3-x}$

……..……(2)

(b) Show that using the substitution $y = 2^x$, the equation

$$2^{x+2} + 2^{3-x} = 33$$

can be rewritten as

$$4y^2 - 33y + 8 = 0$$

……..……(2)

(c)Hence solve the equation

$$2^{x+2} + 2^{3-x} = 33$$

x = ……..……(4)

**[Total 8 marks]**

8

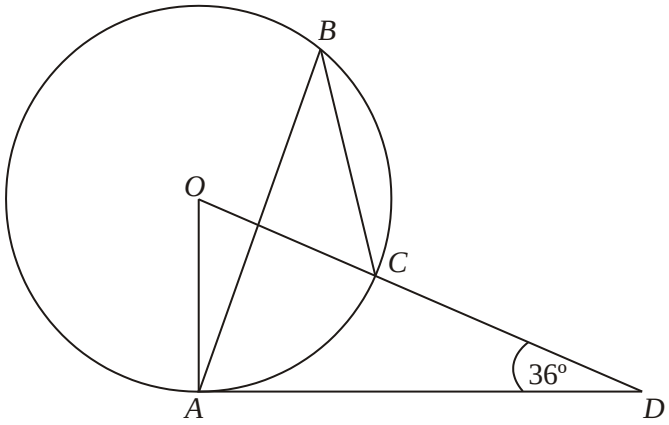



Diagram **NOT** accurately drawn

The diagram shows a circle centre *O*.
*A*, *B* and *C* are points on the circumference.

*DCO* is a straight line.
*DA* is a tangent to the circle.

Angle *ADO* = 36°

(a) Work out the size of angle *AOD*.

..... °

(2)

(b) (i) Work out the size of angle *ABC*.

..... °

(iii) Give a reason for your answer.

.....

.....

(3)

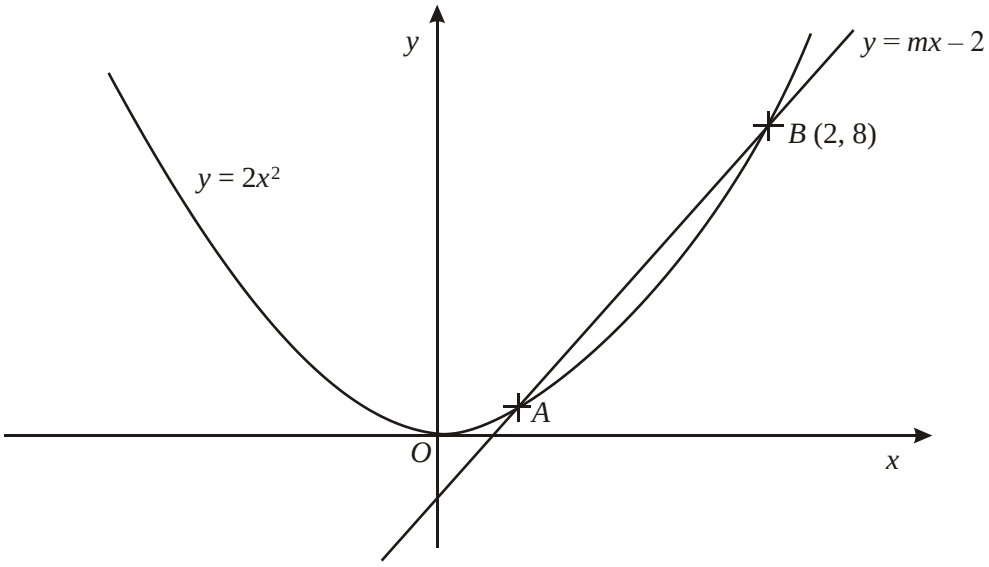
**[Total 5 marks]**

9 a) Find the equation of the straight line which passes through the point (0, 3) and is perpendicular to the straight line with equation $y = 2x$.

.....

(2)

The graphs of $y = 2x^2$ and $y = mx - 2$ intersect at the points $A$ and $B$. The point $B$ has coordinates (2, 8).



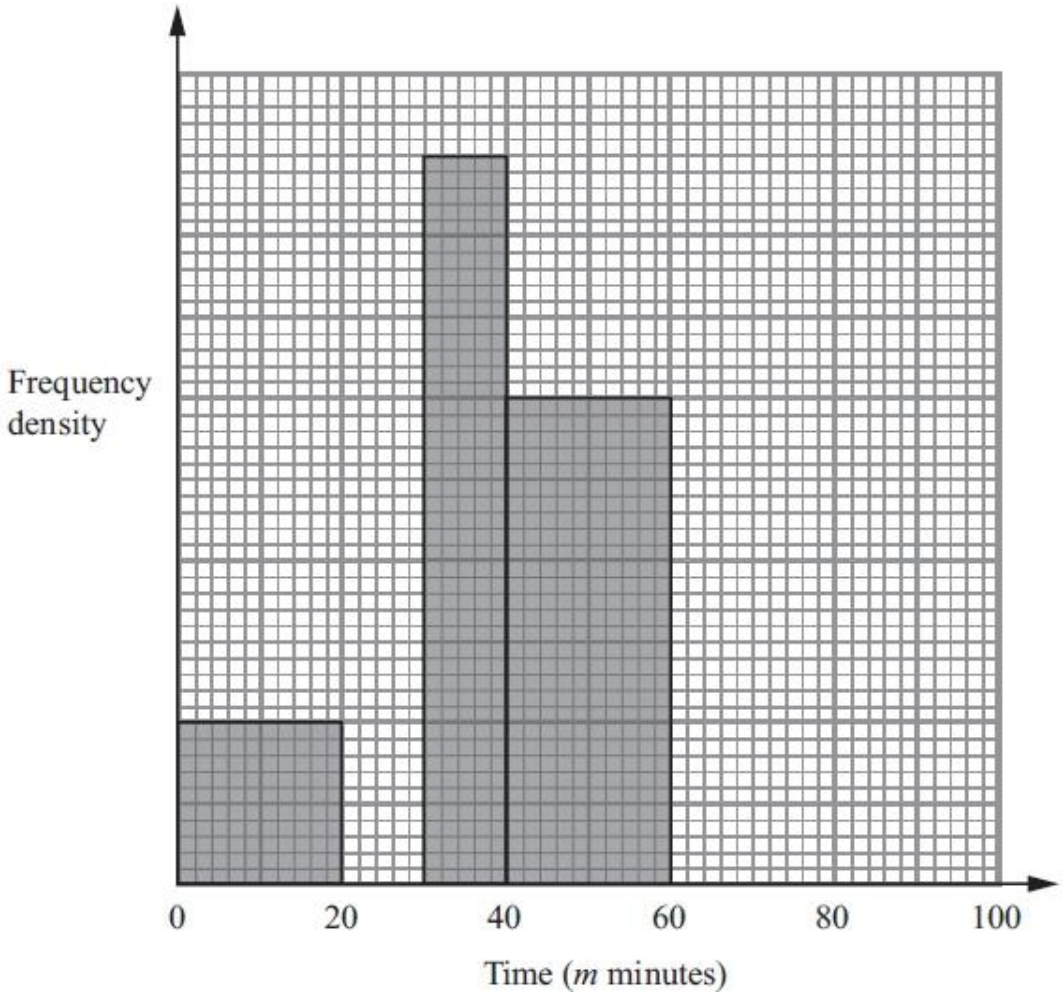

(b) Find the coordinates of the point $A$.

(....., .....) (4)

**[Total 6 marks]**

10 The table and the histogram show some information about the time, in minutes, taken by a group of students to travel to college in one week.

| Time ($m$ minutes) | Frequency |
|---|---|
| $0 < m \leqslant 20$ | 20 |
| $20 < m \leqslant 30$ | 30 |
| $30 < m \leqslant 40$ | |
| $40 < m \leqslant 60$ | |
| $60 < m \leqslant 100$ | 48 |




(a) Use the histogram to complete the table.

(2)

(b) Use the table to complete the histogram.

(2)

**[Total 4 marks]**

11 Solve the simultaneous equations

$$5x + 2y = 11$$
$$4x - 3y = 18$$

x =……..……

y =……..……

**[Total 4 marks]**

12 Solve

$$\frac{5}{x - 2} - \frac{2}{x + 2} = \frac{2x + 21}{x^2 - 4}$$

……..……

**[Total 4 marks]**

**END OF TEST – GO BACK AND CHECK YOUR WORK**