

FOR OFFICIAL USE



National  
Qualifications  
2015

Mark

X747/75/01

Mathematics  
Paper 1  
(Non-Calculator)

TUESDAY, 19 MAY  
9:00AM – 10:00AM



\* X 7 4 7 7 5 0 1 \*

Fill in these boxes and read what is printed below.

Full name of centre

Town

Forename(s)

Surname

Number of seat

Date of birth

Day

Month

Year

Scottish candidate number

Total marks — 40

Attempt ALL questions.

You may NOT use a calculator.

Full credit will be given only to solutions which contain appropriate working.

State the units for your answer where appropriate.

Write your answers clearly in the spaces provided in this booklet. Additional space for answers is provided at the end of this booklet. If you use this space you must clearly identify the question number you are attempting.

Use blue or black ink.

Before leaving the examination room you must give this booklet to the Invigilator; if you do not, you may lose all the marks for this paper.



\* X 7 4 7 7 5 0 1 0 1 \*

## FORMULAE LIST

The roots of  $ax^2 + bx + c = 0$  are  $x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$

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

Cosine rule:  $a^2 = b^2 + c^2 - 2bc \cos A$  or  $\cos A = \frac{b^2 + c^2 - a^2}{2bc}$

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

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

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

Volume of a pyramid:  $V = \frac{1}{3} Ah$

Standard deviation:  $s = \sqrt{\frac{\Sigma(x - \bar{x})^2}{n-1}} = \sqrt{\frac{\Sigma x^2 - (\Sigma x)^2/n}{n-1}}$ , where  $n$  is the sample size.



\* X 7 4 7 7 5 0 1 0 2 \*

1. Evaluate  $6\frac{1}{5} - 2\frac{1}{3}$ .

$$4\frac{1}{5} - \frac{1}{3}$$

$$\frac{21}{5} - \frac{1}{3}$$

$$\frac{63}{15} - \frac{5}{15}$$

$$\frac{58}{15} \quad \text{or} \quad 3\frac{13}{15}$$

2. Solve algebraically the inequality

$$11 - 2(1 + 3x) < 39$$

$$11 - 2 - 6x < 39$$

$$9 - 6x < 39$$

$$-6x < 30$$

$$x > \frac{30}{-6}$$

$$x > -5$$

2.

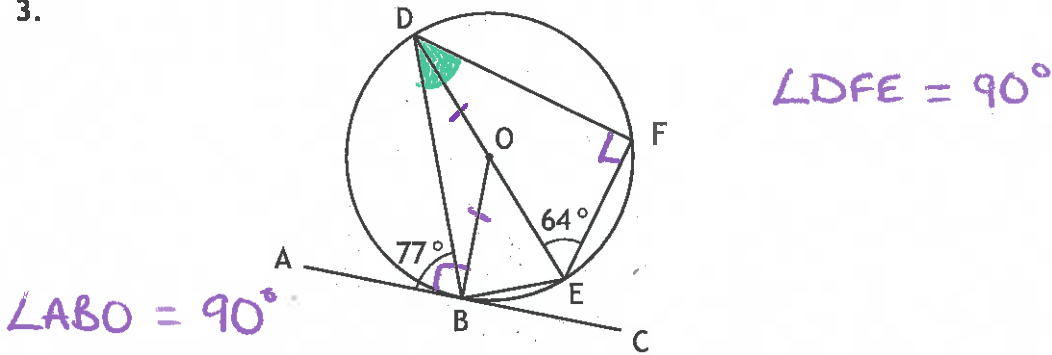
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\* X 7 4 7 7 5 0 1 0 3 \*

3.



AC is a tangent to the circle, centre O, with point of contact B.  
 DE is a diameter of the circle and F is a point on the circumference.  
 Angle ABD is  $77^\circ$  and angle DEF is  $64^\circ$ .  
Calculate the size of angle BDF.

3

$$\begin{aligned} \angle DBO &= \angle BDO \\ &= 90 - 77 \\ &= 13^\circ \end{aligned}$$

$$\begin{aligned} \angle EDF &= 180 - 90 - 64 \\ &= 26^\circ \end{aligned}$$

$$\underline{\underline{\angle BDF = 13 + 26 = 39^\circ}}$$

4. Multiply out the brackets and collect like terms

$$(x-4)(x^2+x-2)$$

3

$$x(x^2+x-2) - 4(x^2+x-2)$$

$$x^3 + x^2 - 2x - 4x^2 - 4x + 8$$

$$\underline{\underline{x^3 - 3x^2 - 6x + 8}}$$



5. The standard deviation of 1, 2, 2, 2, 8 is equal to  $\sqrt{a}$ .

Find the value of a.

3

$$\sum x = 1 + 2 + 2 + 2 + 8 = 15$$

$$\sum x^2 = 1^2 + 2^2 + 2^2 + 2^2 + 8^2 = 77$$

$$sd = \sqrt{\frac{\sum x^2 - (\sum x)^2/n}{n-1}}$$

$$= \sqrt{\frac{77 - 15^2/5}{4}}$$

$$\frac{15^2}{5} = \frac{225}{5}$$

$$= \sqrt{\frac{77 - 45}{4}}$$

$$= \sqrt{\frac{32}{4}}$$

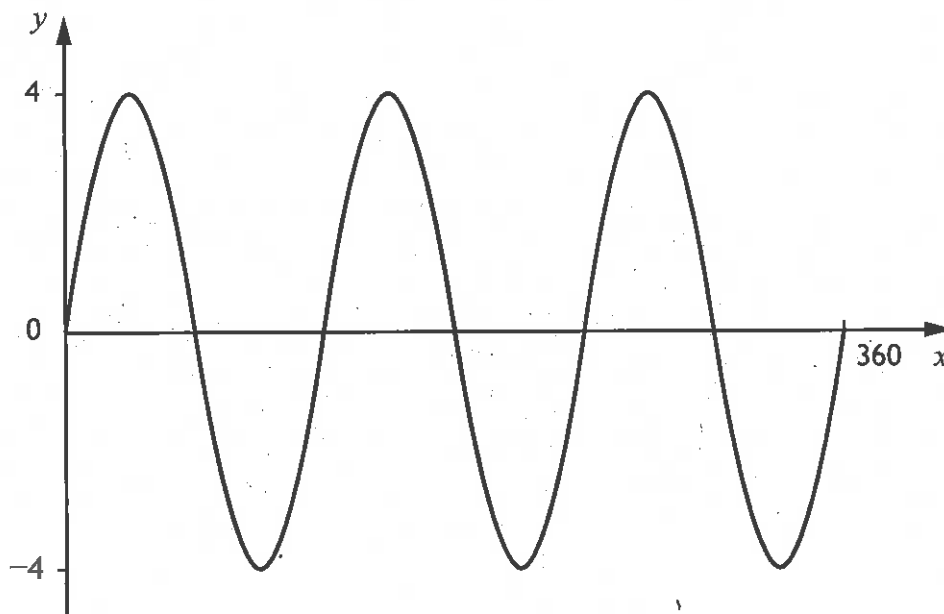
[Turn over

$$\underline{sd = \sqrt{8}}$$

$$\rightarrow \underline{\underline{a = 8}}$$



6. Part of the graph of  $y = a \sin bx^\circ$  is shown in the diagram.



State the values of  $a$  and  $b$ .

2

Amplitude = 4

3 waves in  $360^\circ$

$$y = 4 \sin 3x^\circ$$

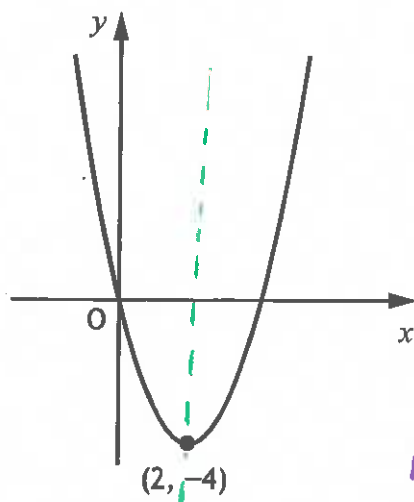
$a = 4$  and  $b = 3$



\* X 7 4 7 7 5 0 1 0 6 \*

7. The graph below shows part of the parabola with equation of the form

$$y = (x+a)^2 + b.$$



Min TP  $(-a, b)$

The minimum turning point  $(2, -4)$  is shown in the diagram.

(a) State the values of

(i)  $a$

$a = -2$

1

(ii)  $b$ .

$b = -4$

1

(b) Write down the equation of the axis of symmetry of the graph.

1

$x = 2$

[Turn over



\* X 7 4 7 7 5 0 1 0 7 \*

8. Find the equation of the line joining the points  $(-2, 5)$  and  $(3, 15)$ .  
Give the equation in its simplest form.

$x_1, y_1, x_2, y_2$

3

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{15 - 5}{3 - (-2)} = \frac{10}{5} = 2$$

Equation

$$y - b = m(x - a)$$

$$m = 2$$

$$y - 15 = 2(x - 3)$$

$$a = 3$$

$$y - 15 = 2x - 6$$

$$b = 15$$

$$\underline{\underline{y = 2x + 9}}$$

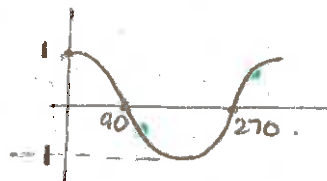
9. Write the following in order of size starting with the smallest.

$$\cos 90^\circ \quad \cos 100^\circ \quad \cos 300^\circ$$

Justify your answer.

2

consider  $y = \cos x^\circ$



$$\cos 90^\circ = 0$$

$$\cos 100^\circ < 0$$

$$\cos 300^\circ > 0$$

$\cos 100^\circ$ ,  $\cos 90^\circ$ ,  $\cos 300^\circ$   
Smallest largest.



10. Ten couples took part in a dance competition.  
The couples were given a score in each round.  
The scores in the first round were

16 27 12 18 26 21 27 22 18 17

(a) Calculate the median and semi-interquartile range of these scores. 3

12 16 17 18 18 | 21 22 26 27 27

$Q_1 = 17$

$Q_2 = 19.5$

$Q_3 = 26$

$IQR = Q_3 - Q_1$

$= 26 - 17$

$= 9$

$SIQR = \frac{1}{2} \text{ of } 9$

$SIQR = 4.5$

Median = 19.5

(b) In the second round, the median was 26 and the semi-interquartile range was 2.5.

Make two valid comparisons between the scores in the first and second rounds. 2

First round 19.5 4.5

second round 26↑ 2.5↓

On average, the ten couples scored higher in the second round compared to the first round (since  $26 > 19.5$ )

The scores of the ten couples were more consistent in the second round compared to the first (since  $2.5 < 4.5$ ).



11. Solve algebraically the system of equations

$$3x + 2y = 17 \quad \times 5$$

$$2x + 5y = 4 \quad \times 2$$

3

$$15x + 10y = 85$$

$$\ominus \quad 4x + 10y = 8$$

$$11x = 77$$

$$\underline{x = 7}$$

$$2x + 5y = 4$$

$$2(7) + 5y = 4$$

$$14 + 5y = 4$$

$$5y = -10$$

$$\underline{y = -2}$$

$$\underline{\underline{x = 7 \text{ and } y = -2}}$$



12. Simplify  $\frac{x^2 - 4x}{x^2 + x - 20}$ .

Factorise!

$$= \frac{x(x-4)}{(x+5)(x-4)}$$

$$= \frac{x}{x+5}$$

MARKS

DO NOT  
WRITE IN  
THIS  
MARGIN

3

[Turn over for Question 13 on Page twelve



\* X 7 4 7 7 5 0 1 1 1 \*

13. Express  $\frac{4}{\sqrt{8}}$  with a rational denominator.

Give your answer in its simplest form.

3

$$\frac{4}{\sqrt{8}} = \frac{4\sqrt{8}}{8} = \frac{\sqrt{8}}{2} = \frac{\sqrt{4}\sqrt{2}}{2} = \frac{2\sqrt{2}}{2}$$

$$\hookrightarrow \underline{\underline{\sqrt{2}}}$$

14. Evaluate  $8^{\frac{5}{3}}$ .

2

$$8^{\frac{5}{3}} = \sqrt[3]{8^5} = 2^5 = \underline{\underline{32}}$$

[END OF QUESTION PAPER]

