

Name _____

Teacher _____

Mathematics

Paper 1

National 5 Booster Paper B1

Duration: 1 hour 15 minutes

Total Marks - 50

Attempt ALL questions.

You may NOT use a calculator

To earn full marks, you must show your working in your answers.

State the units for your answer where appropriate.

Write your answers clearly in the spaces provided in this booklet.

Use blue or black ink.

Notes:

- This is a **Booster Paper**. Your May exam will be (a bit) harder than this.
- The Booster Papers get **more challenging** as you work through them.
- The final Booster Paper will be as challenging as your May exam.
- The number of marks indicated beside each question is intended as a guide and may differ slightly from SQA marking instructions.
- These original papers are **produced independently of the SQA** and are **free of charge**.
- All Booster Papers and answers can be found at www.maths180.com/BoosterPapers

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: $s = \sqrt{\frac{\sum (x - \bar{x})^2}{n - 1}}$

or $s = \sqrt{\frac{\sum x^2 - \frac{(\sum x)^2}{n}}{n - 1}}$, where n is the sample size.

Total marks - 50

Attempt ALL questions

MARKS

1. Multiply the brackets and simplify

$$(3x-2)^2 - (3x-2)$$

3

$$\begin{aligned} &= (3x-2)(3x-2) - (3x-2) \\ &= 9x^2 - 6x - 6x + 4 - 3x + 2 \\ &= \underline{\underline{9x^2 - 15x + 6}} \end{aligned}$$

2. Evaluate $8\frac{3}{4} \div 3\frac{1}{2}$ Leave your answer as a mixed number.

3

$$\begin{aligned} &= \frac{35}{4} \div \frac{7}{2} \\ &= \frac{5}{2} \times \frac{2}{1} \\ &= \frac{5}{2} \times \frac{1}{1} \\ &= \frac{5}{2} \\ &= \underline{\underline{2\frac{1}{2}}} \end{aligned}$$

3. Decrease 280 by 32%

3

$$\begin{aligned} 32\% &= 3 \times 10\% + 2 \times 1\% \\ &\quad \downarrow \qquad \qquad \downarrow \\ 10\% \text{ of } 280 &= 28 & 1\% &= 2.8 \\ 30\% \text{ of } 280 &= 28 \times 3 & 2\% &= 2.8 \times 2 \\ &= 84 & &= 5.6 \end{aligned}$$

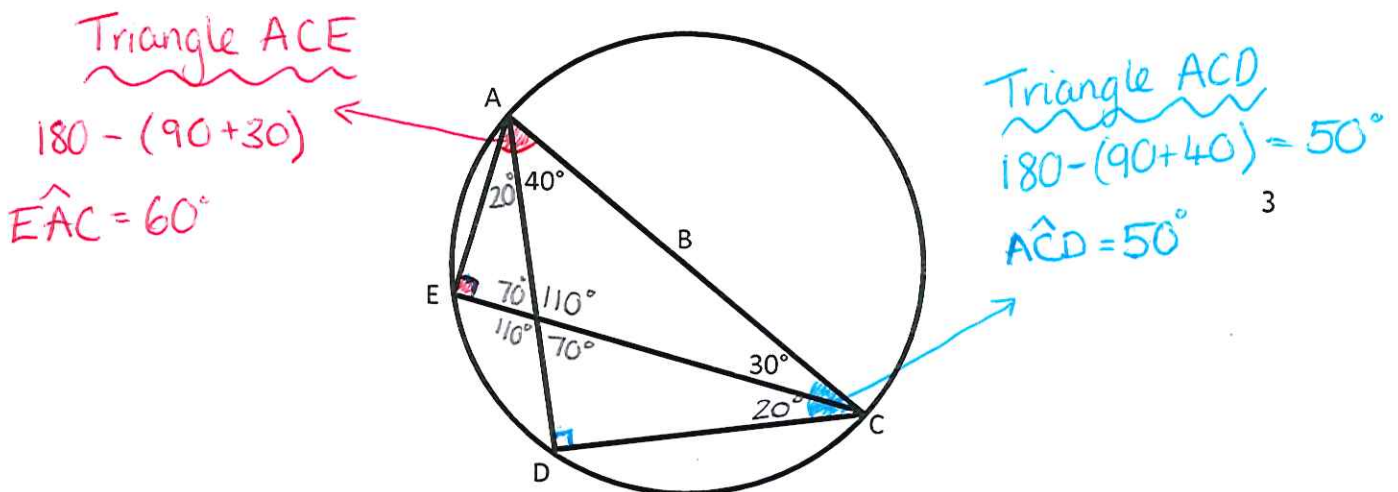
$$\begin{aligned} 32\% &= 84 + 5.6 \\ &= 89.6 \end{aligned}$$

$$280 - 89.6 = \underline{\underline{190.4}}$$

4. This circle has its centre at B. AC is a diameter.

Angle DAB = 40° and angle BCE = 30° .

Fill in all the missing angles.



5. (a) Factorise $30x^2 - 18x$ 1
 $= 6x(5x - 3)$

(b) Factorise $32x^2 - 18$ 2
 $= 2(16x^2 - 9)$
 $= 2(4x + 3)(4x - 3)$

6. Express $x^2 - 8x + 21$ in the form $(x - a)^2 + b$ by completing the square. 2

$$\begin{aligned} & x^2 - 8x + 21 \\ & (x - 4)^2 + 21 - 16 \\ & (x - 4)^2 + 5 \end{aligned}$$

7. Change the subject of the formula to b

$$\sqrt{\frac{b-5}{7}} = m$$

3

$$\frac{b-5}{7} = m^2$$

$$b-5 = 7m^2$$

$$b = 7m^2 + 5$$

8. Polyfilla is on special offer.
Each tube on offer contains 10% more than the standard tube.
A tube on offer contains 330 grams.

How much does the standard tube contain?



3

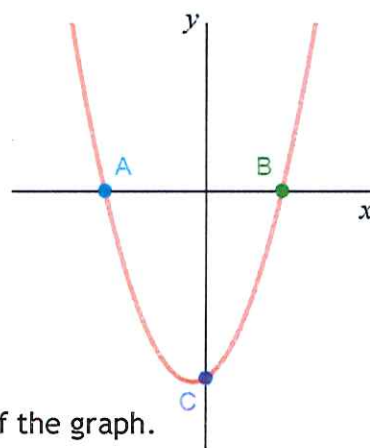
$$\begin{aligned} \div 11 \left\{ \begin{array}{l} 110\% = 330\text{g} \\ 10\% = 30\text{g} \end{array} \right. \div 11 \\ \times 10 \left\{ \begin{array}{l} 100\% = 300\text{g} \end{array} \right. \times 10 \end{aligned}$$

9. Simplify $(4x^3)^2$

2

$$= 4^2 x^{3 \times 2}$$
$$= 16x^6$$

10. The diagram shows part of the graph of a quadratic function with equation $y = x^2 + x - 6$.



(a) Calculate the coordinates of A and B, the roots of the graph.

roots $y=0$

$$y = x^2 + x - 6$$
$$0 = x^2 + x - 6$$
$$0 = (x+3)(x-2)$$

$$x+3=0 \quad x-2=0$$
$$x=-3 \quad x=2$$

$$A(-3, 0) \quad B(2, 0)$$

(b) Write down the coordinates of C, the y -intercept of the graph.

1

y -intercept $x=0$

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

$$C(0, -6)$$

11. Point A $\left(2, \frac{1}{2}\right)$ and point B $(3, 1)$ are joined by a straight line.

(a) Determine the gradient of this line.

2

$$\begin{aligned} m &= \frac{y_2 - y_1}{x_2 - x_1} \\ &= \frac{1 - \frac{1}{2}}{3 - 2} \\ &= \frac{\frac{1}{2}}{1} \\ &= \frac{1}{2} \end{aligned}$$

(b) Determine the equation of the line.

2

$$\begin{aligned} y - b &= m(x - a) & m &= \frac{1}{2} \quad \begin{matrix} (3, 1) \\ a \quad b \end{matrix} \\ y - 1 &= \frac{1}{2}(x - 3) \\ 2y - 2 &= x - 3 \\ 2y &= x - 1 \quad \text{or} \quad y = \frac{1}{2}x - \frac{1}{2} \quad (\text{or any equivalent}) \end{aligned}$$

(c) Find the coordinates of the point where this line crosses the y -axis. 1

crosses y -axis $\Rightarrow x = 0$

$$\begin{aligned} 2y &= x - 1 \\ 2y &= 0 - 1 \\ 2y &= -1 \\ y &= -\frac{1}{2} \quad \left(0, -\frac{1}{2}\right) \end{aligned}$$

12. (a) Fully simplify $\sqrt{125} - \sqrt{5} + \sqrt{20}$.

3

$$\begin{aligned} &= \sqrt{25 \times 5} - \sqrt{5} + \sqrt{4 \times 5} \\ &= \sqrt{25} \times \sqrt{5} - \sqrt{5} + \sqrt{4} \times \sqrt{5} \\ &= 5\sqrt{5} - \sqrt{5} + 2\sqrt{5} \\ &= 6\sqrt{5} \end{aligned}$$

(b) Write $\frac{10}{3\sqrt{2}}$ with a rational denominator in its simplest form.

2

$$\begin{aligned} &= \frac{10}{3\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} \\ &= \frac{10\sqrt{2}}{3 \times 2} \\ &= \frac{5\cancel{10}\sqrt{2}}{\cancel{6}3} \\ &= \frac{5\sqrt{2}}{3} \end{aligned}$$

13. A bag contains 40 coins. The coins are either 50 pence or 20 pence coins.

Let x represent the number of 50 pence coins and let y represent the number of 20 pence coins.

(a) Write an equation to represent this information.

1

$$x + y = 40 \quad \text{--- (2)}$$

The total value of all the coins in the bag is £15.50.

(b) Write an equation to represent this information.

1

$$50x + 20y = 1550 \quad \text{--- (1)}$$

(c) Find, algebraically, the number of 50 pence coins and the number of 20 pence coins.

4

$$\begin{array}{r} 50x + 20y = 1550 \quad \text{--- (1) } \times 1 \\ x + y = 40 \quad \text{--- (2) } \times 20 \end{array}$$

$$\begin{array}{r} 50x + 20y = 1550 \\ \ominus 20x + 20y = 800 \end{array}$$

$$\begin{array}{r} 30x = 750 \\ \div 10 \quad 3x = 75 \quad \div 10 \\ \div 3 \quad x = 25 \quad \div 3 \\ \hline \end{array}$$

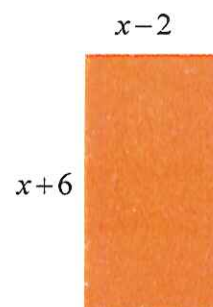
$$\begin{array}{r} x + y = 40 \\ 25 + y = 40 \\ y = 40 - 25 \\ \underline{\underline{y = 15}} \end{array}$$

14. This rectangle has length given by $x+6$ and breadth given by $x-2$. All lengths are in centimetres.

(a) Show that the area can be written as $x^2 + 4x - 12$.

2

$$\begin{aligned} A &= L \times b \\ &= (x-2)(x+6) \\ &= x^2 + 6x - 2x - 12 \\ &= x^2 + 4x - 12 \\ &\text{as required} \end{aligned}$$



The actual area of the rectangle measures 9 square centimetres.

(b) Find, algebraically, the value(s) of x .

4

$$\begin{aligned} A &= x^2 + 4x - 12 \\ 9 &= x^2 + 4x - 12 \\ 0 &= x^2 + 4x - 21 \\ 0 &= (x+7)(x-3) \\ x+7 &= 0 \quad \text{or} \quad x-3=0 \\ x &= -7 & \quad \underline{\underline{x=3}} \\ \text{impossible} & & \end{aligned}$$

End of Booster Paper B1