**Name** Solutions

**Teacher** _____

# Mathematics

## Paper 1

**National 5 Booster Paper D1**

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

Sine Rule: $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

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

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

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

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

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

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

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

**Total marks - 50**

**Attempt ALL questions**

**MARKS**

1. Multiply the brackets and simplify

$$8-5(2x-1)^2$$ 3

$$\begin{aligned}
&= 8-5(2x-1)(2x-1)\\
&= 8-5(4x^2-2x-2x+1)\\
&= 8-5(4x^2-4x+1)\\
&= 8-20x^2+10x-5\\
&= -20x^2+10x+3
\end{aligned}$$

2. Evaluate $12-4\frac{1}{6}\times 1\frac{4}{5}$ Leave your answer as a mixed number. 3

$$\begin{aligned}
&= 12-\frac{25}{6}\times\frac{9}{5}\\
&= 12-\frac{5}{2}\times\frac{3}{1}\\
&= 12-\frac{15}{2}\\
&= \frac{24}{2}-\frac{15}{2}\\
&= \frac{9}{2}=4\frac{1}{2}
\end{aligned}$$

3. Find the percentage decrease from 80 to 28. 3

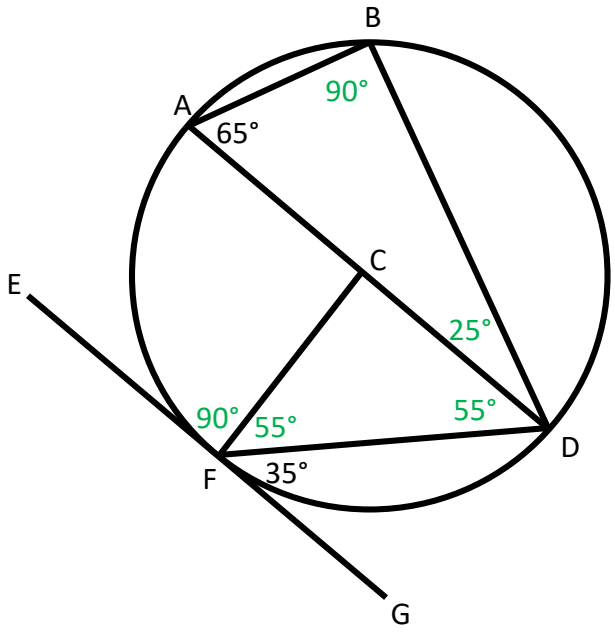
$80 - 28 = 52$

$\frac{52}{80} = \frac{6.5}{10} = \frac{65}{100} = 65\%$

4. This circle has its centre at C.

- EF is a tangent to the circle at F
- Angle BAC = $65^\circ$ and angle DFG = $35^\circ$

Find the size of angle BDF.




3

$B\hat{D}F = 80^\circ$

5. (a) Factorise $x^2 - 9$ 1

$= (x-3)(x+3)$

(b) Fully simplify $\dfrac{x^2-9}{x-3}$ 2

$= \dfrac{(x-3)(x+3)}{x-3}$

$= x+3$

6. Express $x^2 - 12x + 26$ in the form $(x-a)^2 + b$ and write down the values of $a$ and $b$. 2

$= x^2 - 12x + 26$

$= (x-6)^2 - 36 + 26$

$= (x-6)^2 - 10$

$a = 6, \quad b = -10$

7. Change the subject of this formula to $p$.

$$px - 4 = 3p + q$$

3

$px - 4 - 3p = q$

$px - 3p = q + 4$

$p(x - 3) = q + 4$ *(common factor of $p$)*

$p = \dfrac{q + 4}{x - 3}$

8. During the last century, due to poaching and habitat destruction, the black rhino suffered the most drastic decline in total number of all the rhino species.

Between 1970 and 1992, the population decreased by 96%.

In 1992, there were only 2400 surviving in the wild.

How many black rhinos were estimated to be in the wild in 1970? 3

4% = 2400

1% = 600

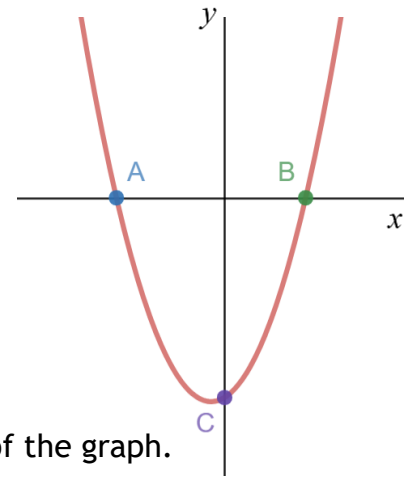
100% = 60000

60000 black rhinos in 1970

9. Find $f(8)$ if $f(x) = x^{\frac{2}{3}}$ 2

$$\begin{aligned} f(8) &= 8^{\frac{2}{3}} \\ &= \sqrt[3]{8}^{2} \\ &= 2^2 \\ &= 4 \end{aligned}$$

10. The diagram shows part of the graph of a quadratic function with equation $y = 2x^2 + x - 3$.




(a) Calculate the **coordinates** of A and B, the roots of the graph. 3

$$2x^2 + x - 3 = 0$$
$$(2x - 3)(x + 1) = 0$$

$2x - 3 = 0$ $\quad$ $x + 1 = 0$

$2x = 3$ $\quad$ $x = -1$

$x = \frac{3}{2}$

$A\left(-\frac{3}{2}, 0\right)$ $\quad$ $B(1, 0)$

(b) Write down the **coordinates** of C, the $y-$ intercept of the graph. 1

$C(0, -3)$

11. A straight line has equation $3y-2x+7=0$.

(a) Determine the gradient of this line. 2

$$3y-2x+7=0$$
$$3y=2x-7$$
$$y=\frac{2}{3}x-\frac{7}{3}$$

$$m=\frac{2}{3}$$

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

$$\left(0,-\frac{7}{3}\right)$$

(c) Determine whether the line passes through the point $(5,1)$. 2

When $x=5$,

$$3y-2(5)+7=0$$
$$3y-3=0$$
$$3y=3$$
$$y=1$$

Therefore, $(5,1)$ lies on the line

12. (a) Fully simplify $\frac{\sqrt{96}}{18}$. 3

$$= \frac{\sqrt{16}\sqrt{6}}{18}$$
$$= \frac{4\sqrt{6}}{18}$$
$$= \frac{2\sqrt{6}}{9}$$

(b) Write $\frac{4}{\sqrt{54}}$ with a rational denominator in its simplest form. 2

$$= \frac{4}{\sqrt{9}\sqrt{6}}$$
$$= \frac{4}{3\sqrt{6}}$$
$$= \frac{4\sqrt{6}}{3\sqrt{6}\sqrt{6}}$$
$$= \frac{4\sqrt{6}}{18}$$
$$= \frac{2\sqrt{6}}{9}$$

13. Tickets for a roller-coaster ride are sold as either child tickets or adult tickets.

Last Saturday, 212 people rode the roller-coaster.

(a) Write an equation to represent this information. 1

Let $a$ represent the number of adult tickets sold and $c$ represent the number of child tickets sold.

$$a + c = 212$$

The tickets cost £6 for a child and £10 for an adult.

Last Saturday, a total of £1688 was taken in ticket sales.

(b) Write an equation to represent this information. 1

$$10a + 6c = 1688$$

(c) Find, algebraically, the number of child tickets sold and the number of adult tickets sold. 4

$$a + c = 212 \quad (\times 10)$$
$$10a + 6c = 1688$$

(subtract)

$$10a + 10c = 2120$$
$$10a + 6c = 1688$$
$$4c = 432$$
$$c = 108$$

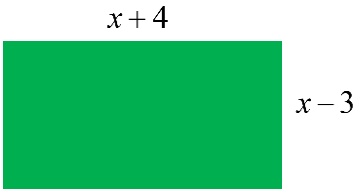
108 child tickets sold

$$a + c = 212$$
$$a + 108 = 212$$
$$a = 104$$

104 adult tickets sold

14. This rectangle has length given by $x+4$ and breadth given by $x-3$.
All lengths are in centimetres.

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




$A = l \times b$
$= (x+4)(x-3)$
$= x^2 - 3x + 4x - 12$
$= x^2 + x - 12$

The actual area of the rectangle measures 18 square centimetres.

(b) Find, algebraically, the value(s) of $x$. 4

$x^2 + x - 12 = 18$
$x^2 + x - 30 = 0$
$(x+6)(x-5) = 0$
$x+6=0 \qquad x-5=0$
$\cancel{x=-6} \qquad x=5$

$x = 5$ since $x > 3$ (for the rectangle to exist)

***End of Booster Paper D1***