Dr Oliver Mathematics
Mathematics: National Qualifications N5
2025 Paper 1: Non-Calculator
1 hour

The total number of marks available is 40.
To earn full marks you must show your working in your answers.

1. Evaluate (2)

$$2\tfrac{4}{5} \times \tfrac{2}{7}.$$

Give your answer in its simplest form.

Solution

Well,

$$\begin{aligned} 2\tfrac{4}{5} \times \tfrac{2}{7} &= \tfrac{14}{5} \times \tfrac{2}{7} \\ &= \tfrac{\cancel{14}^{2}}{5} \times \tfrac{2}{\cancel{7}^{1}} \\ &= \tfrac{2}{5} \times \tfrac{2}{1} \\ &= \underline{\underline{\tfrac{4}{5}}}. \end{aligned}$$

2. Expand and simplify (3)

$$(x+3)(x+5) + 4(x-2).$$

Solution

Now,

$\times$	x	$+3$
x	x^2	$+3x$
$+5$	$+5x$	$+15$

and so

$$\begin{aligned} (x+3)(x+5) + 4(x-2) &= x^2 + 8x + 15 + 4x - 8 \\ &= \underline{\underline{x^2 + 12x + 7}}. \end{aligned}$$

3. Ten pupils record the length of time, in minutes, it takes them to walk to school one morning: (2)

$$3 \quad 11 \quad 13 \quad 15 \quad 15 \quad 16 \quad 17 \quad 18 \quad 19 \quad 22$$

Calculate the interquartile range of these times.

Solution

Well,

$$\begin{aligned} \text{lower quartile} &= \left(\frac{10+1}{4}\right)\text{th place} \\ &= 2\tfrac{3}{4}\text{th place} \\ &\approx 3\text{rd place} \end{aligned}$$

and

$$\begin{aligned} \text{upper quartile} &= \left(\frac{3(10+1)}{4}\right)\text{th place} \\ &= 8\tfrac{1}{4}\text{th place} \\ &\approx 8\text{th place.} \end{aligned}$$

Now, the 3rd entry is 13 and the 8th entry is 18.

Finally,

$$\begin{aligned} \text{interquartile range} &= \text{upper quartile} - \text{lower quartile} \\ &= 18 - 13 \\ &= \underline{\underline{5}}. \end{aligned}$$

4. In a sale, the price of a wedding dress is reduced by 20%. (3)

The sale price of the dress is £720.

Calculate the price of the dress before the sale.

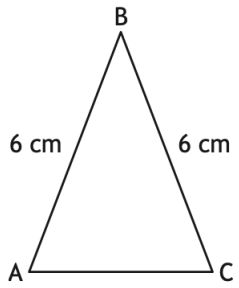
Solution

Well,

$$\begin{aligned}\text{old price} \times \text{discount} = \text{new price} &\Rightarrow \text{old price} \times (1 - 0.2) = 720\\ &\Rightarrow \text{old price} \times 0.8 = 720\\ &\Rightarrow \text{old price} = \frac{720}{0.8}\\ &\Rightarrow \text{old price} = \frac{7\,200}{8}\\ &\Rightarrow \text{old price} = 900;\end{aligned}$$

hence, the price of the dress before the sale was $\underline{\underline{£900}}$.

5. Triangle ABC is shown in the diagram. (2)



- $AB = BC = 6$ centimetres.
- $\sin ABC = \frac{2}{3}$.

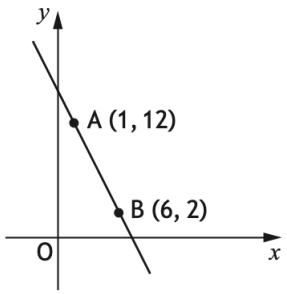
Calculate the area of the triangle.

Solution

Well,

$$\begin{aligned}\text{area of } ABC &= \tfrac{1}{2} \times AB \times BC \times \sin ABC\\ &= \tfrac{1}{2} \times 6 \times 6 \times \tfrac{2}{3}\\ &= \underline{\underline{12 \text{ cm}^2}}.\end{aligned}$$

6. The diagram shows the straight line passing through points A and B. (3)



Find the equation of the line AB.
Give the equation in its simplest form.

Solution

Well,

$$\begin{aligned} m_{AB} &= \frac{2-12}{6-1} \\ &= \frac{-10}{5} \\ &= -2, \end{aligned}$$

and the equation of the line AB is

$$\begin{aligned} y - 2 = -2(x-6) &\Rightarrow y - 2 = -2x + 12 \\ &\Rightarrow \underline{\underline{y = -2x + 14}}. \end{aligned}$$

7. A function is defined as

$$\mathrm{f}(x) = 3x + 7.$$

(a) Evaluate f(6). (1)

Solution

Well,

$$\begin{aligned} \mathrm{f}(6) &= 3(6) + 7 \\ &= 18 + 7 \\ &= \underline{\underline{25}}. \end{aligned}$$

(b) Given that (2)

$$\mathrm{f}(p) = 19,$$

find the value of p.

Solution

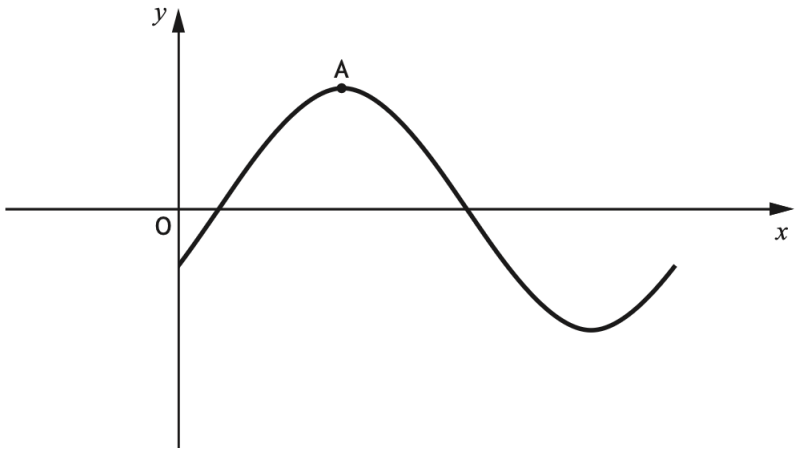
Now,

$$3p + 7 = 19 \Rightarrow 3p = 12$$
$$\Rightarrow \underline{\underline{p = 4}}.$$

8. Part of the graph of (2)

$$y = 2\sin(x - 30)^\circ$$

is shown in the diagram.



The graph has a maximum turning point at A.

State the coordinates of A.

Solution

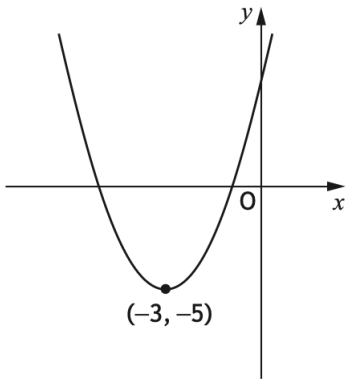
Well,

$$x - 30 = 90 \Rightarrow x = 120$$

and so the graph has a maximum turning point at $\underline{\underline{A(120, 2)}}$.

9. The diagram shows a parabola with equation of the form

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



(a) State the value of a. (1)

Solution

$\underline{\underline{a = 3}}$.

(b) State the value of b. (1)

Solution

$\underline{\underline{b = -5}}$.

10. Simplify (3)

$$\frac{n^7 \times (n^3)^2}{n^4}.$$

Solution

Now,

$$\begin{aligned}\frac{n^7 \times (n^3)^2}{n^4} &= \frac{n^7 \times n^6}{n^4} \\ &= \frac{n^{13}}{n^4} \\ &= \underline{\underline{n^9}}.\end{aligned}$$

11. Determine the nature of the roots of the function (2)

$$\mathrm{f}(x) = 3x^2 + 2x + 1.$$

Solution

Well, $a = 3$, $b = 2$, and $c = 1$:

$$\begin{aligned} b^2 - 4ac &= 2^2 - 4(3)(1) \\ &= 4 - 12 \\ &= -8 \\ &< 0; \end{aligned}$$

hence, there are no real roots.

12. Express (2)

$$\frac{6}{\sqrt{10}}$$

with a rational denominator.
Give your answer in its simplest form.

Solution

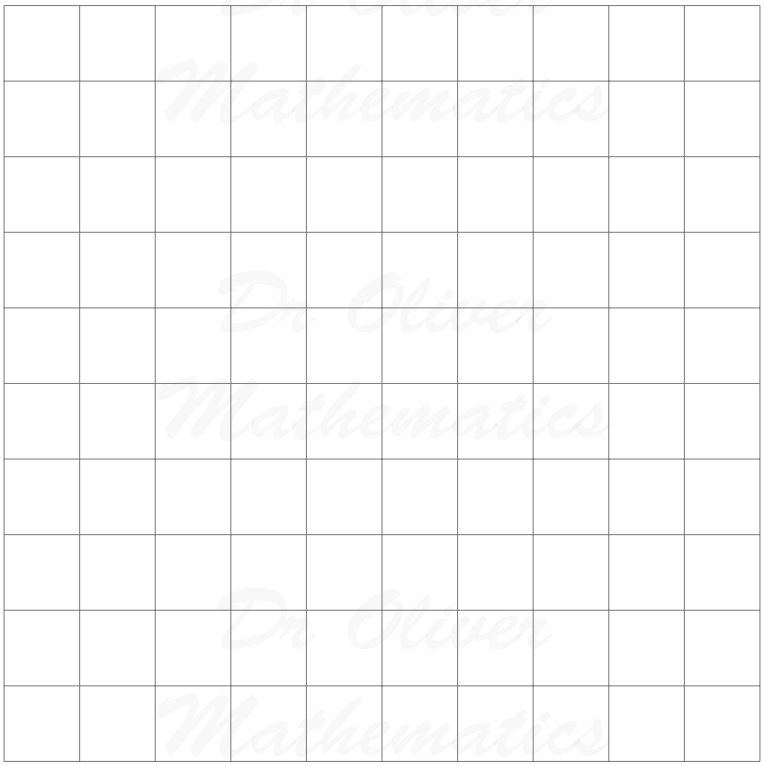
Well,

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

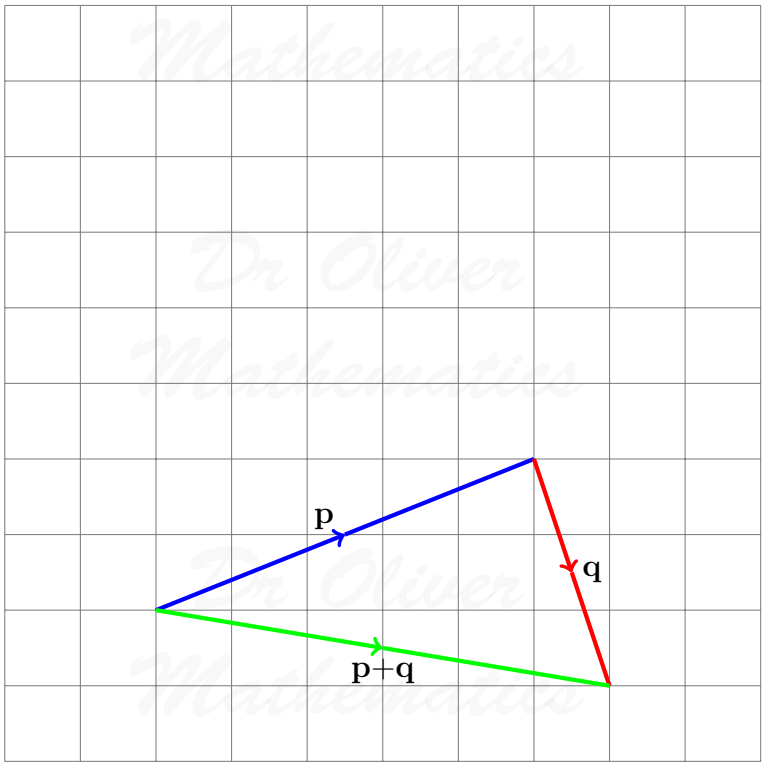
13. Vectors $\mathbf{p}$ and $\mathbf{q}$ have components (2)

$$\mathbf{p} = \begin{pmatrix} 5 \\ 2 \end{pmatrix} \text{ and } \mathbf{q} = \begin{pmatrix} 1 \\ -3 \end{pmatrix}.$$

Draw the resultant vector $\mathbf{p} + \mathbf{q}$ on the grid.



Solution



14. Express (3)

$$\frac{5}{x-1} - \frac{4}{x},\ x \neq 1,\ x \neq 0,$$

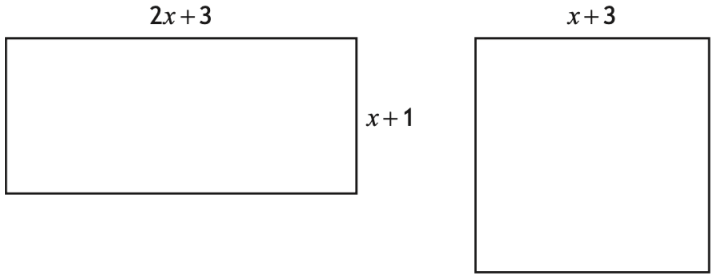
as a single fraction in its simplest form.

Solution

We multiply the first fraction top and bottom by x and we multiply the second fraction top and bottom by $(x-1)$:

$$\begin{aligned}\frac{5}{x-1} - \frac{4}{x} &= \frac{5x}{x(x-1)} - \frac{4(x-1)}{x(x-1)} \\ &= \frac{5x - 4(x-1)}{x(x-1)} \\ &= \frac{5x4x + 4}{x(x-1)} \\ &= \underline{\underline{\frac{x+4}{x(x-1)}}}.\end{aligned}$$

15. The diagrams of a rectangle and square are shown below.
All measurements are in centimetres.



(a) Find an expression for the area of the **rectangle**. (1)

Solution

Well,

$\times$	$2x$	$+3$
x	$2x^2$	$+3x$
$+1$	$+2x$	$+3$

and so

$$(2x+3)(x+1) = \underline{\underline{2x^2+5x+3}}.$$

(b) Given that the area of the rectangle is equal to the area of the square, show that (2)

$$x^2 - x - 6 = 0.$$

Solution

Now,

$\times$	x	$+3$
x	x^2	$+3x$
$+3$	$+3x$	$+9$

and so

$$(x+3)^2 = x^2 + 6x + 9.$$

Finally, the area of the rectangle is equal to the area of the square so

$$2x^2 + 5x + 3 = x^2 + 6x + 9 \Rightarrow \underline{\underline{x^2 - x - 6 = 0}},$$

as required.

(c) Hence find, algebraically, the length and breadth of the rectangle. (3)

Solution

Well,

$$\left.\begin{array}{ll} \text{add to:} & -1 \\ \text{multiply to:} & -6 \end{array}\right\} + 2, -3$$

and so

$$\begin{aligned} x^2 - x - 6 = 0 &\Rightarrow (x+2)(x-3) = 0 \\ &\Rightarrow x + 2 = 0 \text{ or } x - 3 = 0 \\ &\Rightarrow x = -2 \text{ or } x = 3. \end{aligned}$$

But $x \neq -2$ (why?). Hence, the length is

$$2(3) + 3 = \underline{\underline{9 \text{ cm}}}$$

and the breadth is

$$3 + 1 = \underline{\underline{4 \text{ cm}}}.$$