# AS Mathematics Preparation – Homework Questions

*These questions must be completed for and brought to your first mathematics lesson. You must attempt every question.*

Answer the following questions neatly on paper, showing your full working out. Marks will be awarded for working. **(N.B. Correct answers without marking will not carry full marks)**

1. (a) Work out $1\frac{7}{8} \times 5\frac{1}{3}$

**(2)**

(b) Work out $3\frac{1}{2} \div 2\frac{4}{5}$

**(2)**

**(Total 4 marks)**

2. Express the following in their simplest form:

(a) i) $9^{\frac{1}{2}}$ ii) $81^{\frac{1}{4}}$ iii) $27^{0}$

**(3)**

(b) i) $4^{-\frac{3}{2}}$ ii) $64^{\frac{5}{6}}$ iii) $64^{-\frac{2}{3}}$

**(3)**

(c) i) $\left(\frac{125}{8}\right)^{\frac{1}{3}}$ ii) $\left(\frac{16}{9}\right)^{-\frac{3}{2}}$

**(4)**

**(Total 10 marks)**

3. (a) Express the following in their simplest form:

(i) $b^5 \times b^6$

(ii) $g^7 \div g^3$

(iii) $y^{10} \times y^2 \div y^5$

(iv) $(3a^5)^2$

**(4)**

(b) $4n^{\frac{3}{2}} = 8^{-\frac{1}{3}}$

Find the value of *n*.

**(3)**

**(Total 7 marks)**

4. Simplify the following as fully as possible:

a) (i) $\sqrt{20}$ ii) $\sqrt{75}$ iii) $\sqrt{720}$

**(3)**

b) $\dfrac{(5+\sqrt{3})(5-\sqrt{3})}{\sqrt{22}}$

**(3)**

**(Total 6 marks)**

5. (a) Given that $\sqrt{40} = k\sqrt{10}$, find the value of *k.*

**(1)**

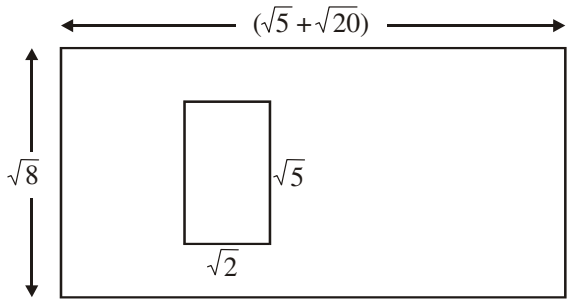



Diagram **NOT** accurately drawn

A large rectangular piece of card is $(\sqrt{5}+\sqrt{20})$ cm long and $\sqrt{8}$ cm wide.

A small rectangle $\sqrt{2}$ cm long and $\sqrt{5}$ cm wide is cut out of the piece of card.

(b) Express the area of the card that is left as a percentage of the area of the large rectangle.

**(4)**

**(Total 5 marks)**

6. Solve the following quadratic equations by factorising:

a) $x^2 + 3x + 2 = 0$

**(3)**

b) $x^2 + 4x - 12 = 0$

**(3)**

c) $x^2 - 14x + 40 = 0$

**(3)**

d) $2x^2 + 9x + 9 = 0$

**(3)**

e) $5x^2 + 13x + 6 = 0$

**(3)**

f) $3x^2 - 16x + 21 = 0$

**(3)**

**(Total 18 marks)**

7. Solve the following quadratic equations by using the quadratic formula:

a) $x^2 + 6x + 6 = 0$

**(2)**

b) $x^2 - 5x - 2 = 0$

**(2)**

c) $5x^2 + 4x - 3 = 0$

**(2)**

**(Total 6 marks)**

8. A cylinder has a height of 10 cm and a surface area of $1200\pi$ cm$^2$.

Work out the radius of the cylinder.

[Hint: let the radius be $r$ cm, then form and solve a quadratic equation for the surface area.]

**(Total 7 marks)**

9. Peter cuts a square out of a rectangular piece of metal.

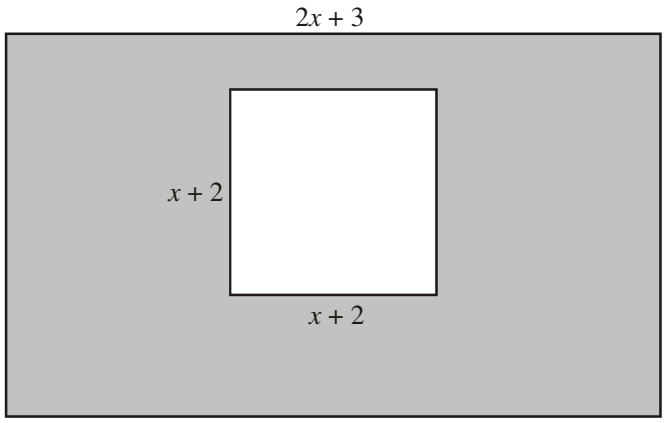



Diagram **NOT** accurately drawn

The length of the rectangle is $2x + 3$.
The width of the rectangle is $x + 4$.
The length of the side of the square is $x + 2$.
All measurements are in centimetres.

The shaded shape in the diagram shows the metal remaining.

The area of the shaded shape is 20 cm$^2$.

(a) Show that $x^2 + 7x - 12 = 0$

**(4)**

(b) (i) Solve the equation $x^2 + 7x - 12 = 0$
Give your answers correct to 4 significant figures.

**(3)**

(ii) Hence, find the perimeter of the square.
Give your answer correct to 3 significant figures.

**(1)**

**(Total 8 marks)**

10. (a) Simplify fully $\dfrac{x^2 - 3x}{x^2 - 8x + 15}$

**(3)**

(b) Solve the equation

$$\frac{7}{x+2} + \frac{1}{x-1} = 4$$

**(7)**

**(Total 10 marks)**

11. Bill said that the line $y = 6$ cuts the curve $x^2 + y^2 = 25$ at two points.

(a) By eliminating $y$ show that Bill is incorrect.

**(2)**

(b) By eliminating $y$, find the solutions to the simultaneous equations

$$x^2 + y^2 = 25$$
$$y = 2x - 2$$

$x =$ ..... $y =$ .....

or $x =$ ..... $y =$ .....

**(6)**

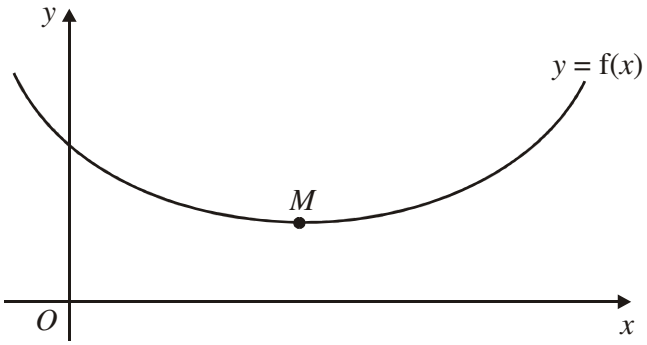
**(Total 8 marks)**

12. The expression $x^2 - 6x + 14$ can be written in the form $(x - p)^2 + q$, for all values of $x$.

(a) Find the value of (i) $p$, (ii) $q$.

**(3)**

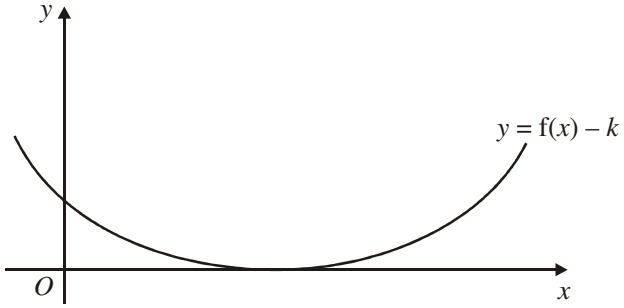
The equation of a curve is $y = f(x)$, where $f(x) = x^2 - 6x + 14$.
Here is a sketch of the graph of $y = f(x)$.




(b) Write down the coordinates of the minimum point, $M$, of the curve.

**(1)**

Here is a sketch of the graph of $y = f(x) - k$, where $k$ is a positive constant.
The graph touches the $x$-axis.




(c) Find the value of $k$.

**(1)**

(d) For the graph of $y = f(x - 1)$,

(i) write down the coordinates of the minimum point,

(ii) find the coordinates of the point where the curve crosses the $y$-axis.

**(3)**

**(Total 8 marks)**

13. (a) Show that $(2a - 1)^2 - (2b - 1)^2 = 4(a - b)(a + b - 1)$

**(3)**

(b) Prove that the difference between the squares of any two odd numbers is a multiple of 8.
(You may assume that any odd number can be written in the form $2r - 1$, where $r$ is an integer).

**(3)**

**(Total 6 marks)**