COMPLETING THE SQUARE

[ESTIMATED TIME: 60 minutes]

GCSE

(+ IGCSE) EXAM QUESTION PRACTICE

1. **[2 marks]**

Write $x^2 + 4x + 5$ in the form $(x + a)^2 + b$ where a and b are integers.

.....

2. **[2 marks]**

For all values of x, $x^2 - 10x + 7 = (x - p)^2 - q$

Find the value of the constants p and q.

p = ...

q = ...

3. **[2 marks]**

Solve the equation $(x - 7)^2 - 5 = 0$

Write your answer in the form $a \pm \sqrt{b}$ where a and b are integers.

.....

4. **[4 marks]**

By completing the square, solve the equation $x^2 + 10x - 3 = 0$

Give your answer in the form $p \pm \sqrt{q}$ where p and q are integers.

.....

5. **[3 marks]**

(a) Write $x^2 + 14x - 9$ in the form $(x + a)^2 + b$ where a and b are integers.

.....

(2)

(b) Hence, or otherwise, write down the coordinates of the turning point of the graph $y = x^2 + 14x - 9$

(..... , ...)

(1)

6. **[3 marks]**

$6x - 7 - x^2 = p - (x + q)^2$ where p and q are integers.

Find the value of p and the value of q.

p = ...

q = ...

7. **[4 marks]**

Write $x^2 - 6x - 3$ in the form $(x + a)^2 + b$ where a and b are integers.

.....

(2)

(b) Hence, or otherwise, solve the equation $x^2 - 6x - 3 = 0$

Write your answers in the form $p \pm \sqrt{q}$ where p and q are integers.

.....

(2)

8. **[3 marks]**

Write $2x^2 + 8x + 13$ in the form $a(x+b)^2 + c$ where a, b and c are integers.

.....

9. **[4 marks]**

(a) Write $2x^2 - 12x + 17$ in the form $a(x-b)^2 + c$ where a, b and c are integers.

.....

(3)

(b) Hence, or otherwise, write down the coordinates of the turning point of the graph $y = 2x^2 - 12x + 17$

(..... , ...)

(1)

10. **[3 marks]**

$x^2 + hx + 15 = (x+3)^2 + k$

Find the value of the constants h and k.

$h =$ .....

$k =$ .....

11. **[3 marks]**

$2x^2 - 20x + 10 = p(x-q)^2 - r$

Find the value of the constants p, q and r.

$p =$ .....

$q =$ .....

$r =$ .....

12. **[3 marks]**

The expression $x^2 - 8x + 21$ can be written in the form $(x - a)^2 + b$ for all values of x.

(a) Find the value of a and the value of b.

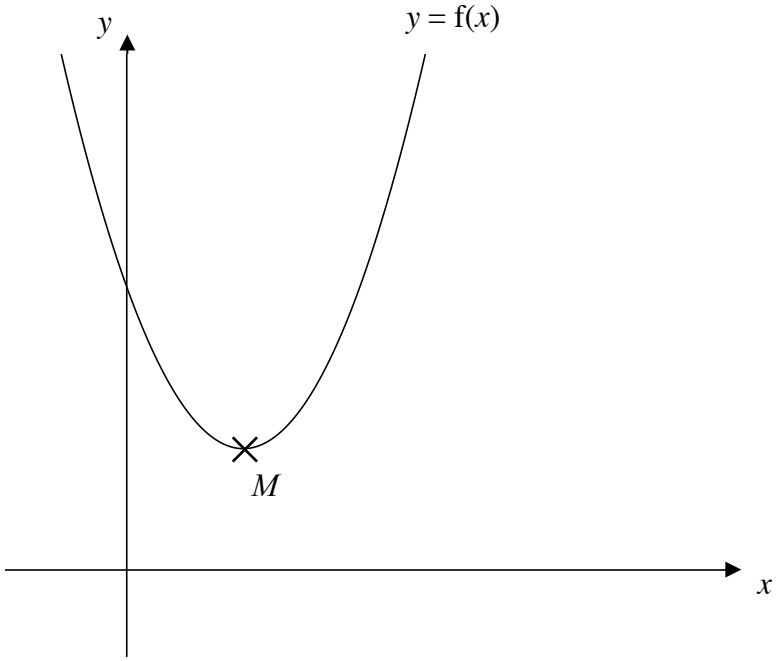
$a =$ .....

$b =$ .....

(2)

The equation of a curve is $y = f(x)$ where $f(x) = x^2 - 8x + 21$

The diagram shows part of a sketch of the graph of $y = f(x)$.



The minimum point of the curve is M.

(b) Write down the coordinates of M.

(..... , ...)

(1)

13. **[4 marks]**

(a) Write $x^2 + 6x + 13$ in the form $(x + a)^2 + b$ where a and b are integers.

.....

(2)

(b) Hence, or otherwise, write down the coordinates of the turning point of the graph $y = x^2 + 6x + 13$

(..... , ...)

(1)

(c) Using your answer to part (b) state the number of solutions to the equation $x^2 + 6x + 13 = 0$
Give a reason for your answer.

Number of solutions .....

Reason: .....

.....

.....

.....

(1)

14. **[5 marks]**

(a) Write $3x^2 - 12x - 1$ in the form $a(x-b)^2 + c$ where a, b and c are integers.

.....

(3)

(b) Hence, or otherwise, find the minimum value of $y = 3x^2 - 12x - 1$

.....

(1)

(c) Using your answer to part (b) find the equation of the line of symmetry of the curve $y = 3x^2 - 12x - 1$

.....

(1)

15. **[2 marks]**

Write $x^2 + 5x + 9$ in the form $(x + a)^2 + b$

.....

16. **[3 marks]**

$x^2 + px + 4 = (x + q)^2 - 5$

Find the value of the constants p and q.

p = ...

q = ...

17. **[3 marks]**

$x^2 + 4x + p = (x + 2)^2 + 3p$

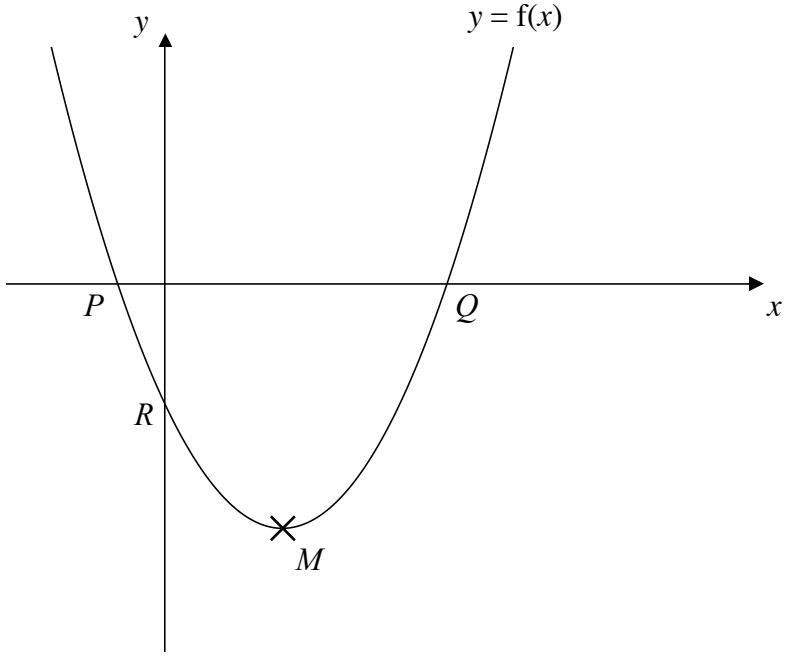
Find the value of p.

p = ...

18. **[6 marks]**

$f(x) = x^2 - 4x - 5$

The diagram show a sketch of the graph of $y = f(x)$



The minimum point of the curve is M.

The points at which the curve crosses the x-axis and the y-axis are P, Q and R.

Find the coordinates of the points M, P, Q and R.

M (..... , ...)

P (..... , ...)

Q (..... , ...)

R (..... , ...)