EXAM PAPERS PRACTICE

GCSE Edexcel Math 1MA1 Completing the square

Answers

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Answer 1

COMPLETING THE SQUARE

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.

$(x-4)^2 = x^2 - 8x + 16$

$a = 4$

$b = 5$

$a =$ 4

$b =$ 5

Answer 2

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

Give your solutions correct to 3 significant figures.

$\sqrt{(x-2)^2} = \sqrt{3}$

$x - 2 = \pm\sqrt{3}$

$+2 \quad +2$

$x = 2 \pm \sqrt{3}$

$x = 2+\sqrt{3}$ or $2-\sqrt{3}$

NOT SIGNIFICANT (LEADING ZERO)

$x = 3.73205\,0808\ldots$ OR $0.26794\,91924\ldots$

< 5 ROUND DOWN

≥ 5 ROUND UP

$x = 3.73$

$x = 0.268$

Answer 3

Write $x^2 + 2x - 8$ in the form $(x + m)^2 + n$ where m and n are integers.

WHOLE NUMBERS

"COMPLETING THE SQUARE"

$x^2 + 2x - 8 = x^2 + 2x + 1 - 9$

$= (x+1)^2 - 9$

$(x+1)^2 = (x+1)(x+1)$

F O I L

$= x^2 + x + x + 1$

$= x^2 + 2x + 1$

Answer 4

(a) Write the quadratic function $y = x^2 + 8x - 9$ in the form $y = a(x + b)^2 + c$ where a, b and c are integers to be found.

COMPLETING THE SQUARE

a) $x^2 + 8x - 9$ $(x+b)^2 + c$

$(x+4)^2 - 4^2 - 9$

$(x+4)^2 - 16 - 9$

$(x+4)^2 - 25$

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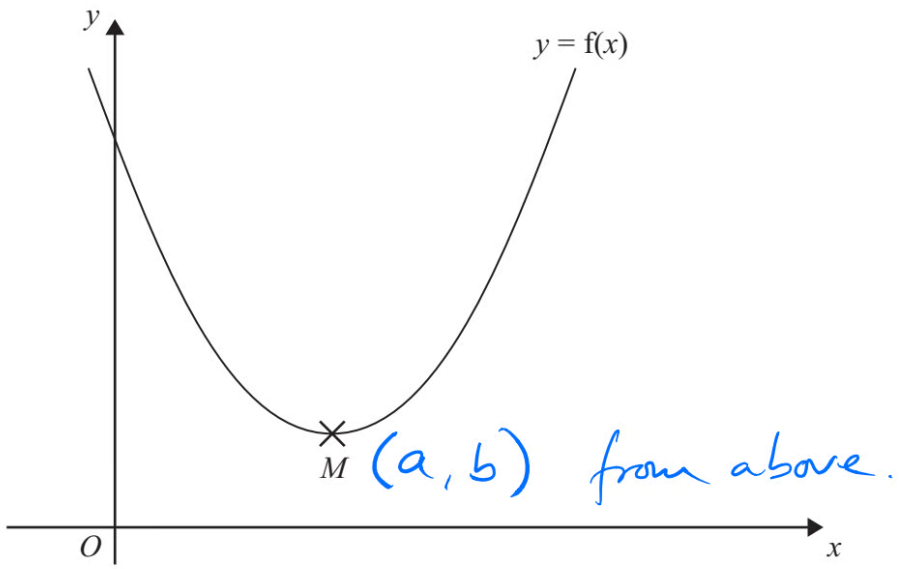
Answer 5

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.

(4 , 5)

Answer 6

"COMPLETING THE SQUARE"

Write $x^2 + 6x - 7$ in the form $(x + a)^2 + b$ where a and b are integers. → WHOLE NUMBERS

HALF OF 6

$x^2 + 6x - 7$

$= (x+3)^2 - 9 - 7$

$= (x+3)^2 - 16$

$(x + 3)^2$

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

F O I L

$= x^2 + 3x + 3x + 9$

$= x^2 + 6x + 9$

Answer 7

Solve $x^2 - 6x - 8 = 0$

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

WHOLE NUMBERS

BEST WAY: COMPLETING THE SQUARE

$x^2 - 6x - 8 = 0$

$(x-3)^2 - 9 - 8 = 0$

$(x-3)^2 - 17 = 0$

$+17 \quad +17$

$(x-3)^2 = 17$

$\sqrt{}$

$x - 3 = \pm\sqrt{17}$

$+3 \quad +3$

$x = 3 \pm \sqrt{17}$

$(x-3)^2$

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

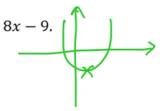
F O I L

$= x^2 - 3x - 3x + 9$

$= x^2 - 6x + 9$

Answer 8

(b) Write down the minimum point on the graph of $y = x^2 + 8x - 9$.



b) $(x+4)^2 - 25$ $(x+b)^2+c$

$(-4, -25)$ $(-b, c)$

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Answer 9

COMPLETING THE SQUARE

(a) Write $2x^2 + 16x + 35$ in the form $a(x + b)^2 + c$ where a, b, and c are integers.

$2x^2 + 16x + 35 = 2(x^2 + 8x) + 35$

$= 2[(x+4)^2 - 16] + 35$

$= 2(x+4)^2 - 32 + 35$

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

$(x+4)^2$

$= (x+4)(x+4)$

F O I L

$= x^2 + 4x + 4x + 16$

$= x^2 + 8x + 16$

Answer 10

(a) Write the quadratic function $y = 4x^2 + 8x - 5$ in the form $y = a(x + b)^2 + c$ where a, b and c are integers to be found.

COMPLETING THE SQUARE

a) $4x^2 + 8x - 5$

$4[x^2 + 2x] - 5$

$4[(x+1)^2 - 1] - 5$

$4(x+1)^2 - 4 - 5$

$4(x+1)^2 - 9$

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Answer 11

(b) Given that $c = 5$, hence, or otherwise, show that the function $f(x) = x^2 + 4x + c$ has no real roots.

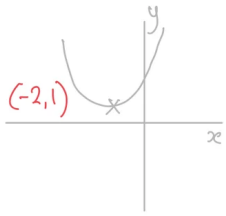
DISCRIMINANT

$b^2 - 4ac < 0$

b) $(-2, c-4)$ MINIMUM

SUBSTITUTE

$c = 5$ $(-2, 1)$ $5-4$



MINIMUM = $(-2, 1)$

y value > 0

$\therefore$ $f(x)$ DOES NOT INTERSECT x AXIS

$\therefore$ NO REAL ROOTS

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Answer 12

(a) Write the quadratic function $y = -6x^2 + 8x - 5$ in the form $y = a - b(x + c)^2$ where a, b and c are constants to be found.

a)

$-6\left[x^2 - \frac{4}{3}x\right] - 5$

COMPLETE THE SQUARE

$-6\left[\left(x - \frac{2}{3}\right)^2 - \frac{4}{9}\right] - 5$

$-6\left(x - \frac{2}{3}\right)^2 + \frac{8}{3} - 5$

$\frac{8}{3} - 5 = -\frac{7}{3}$

$-\frac{7}{3} - 6\left(x - \frac{2}{3}\right)^2$

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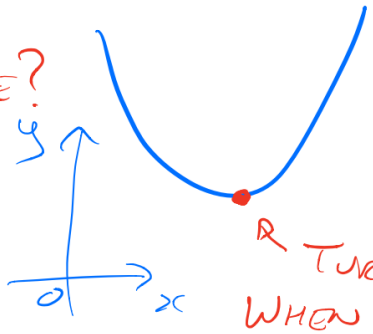
Answer 13

DON'T!

(b) Hence, ~~or otherwise~~, write down the coordinates of the turning point of the graph of $y = 2x^2 + 16x + 35$

POSITIVE QUADRATIC GRAPH

WHAT VALUE OF x MAKES y AS SMALL AS POSSIBLE?



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

$x = -4$ MAKES THIS $= 0$

TURNING POINT WHEN IS AS SMALL AS POSSIBLE

WHEN $x = -4$

$y = 2 \times 0^2 + 3 = 3$

TURNING PT IS $(-4, 3)$

Answer 14

(a) Write the quadratic function $y = 4x^2 + 8x - 5$ in the form $y = a(x + b)^2 + c$ where a, b and c are integers to be found.

(b) Write down the minimum point on the graph of $y = 4x^2 + 8x - 5$.

b)

$4(x+1)^2 - 9$

MINIMUM POINT

$(-1, -9)$

$(-b, c)$

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Answer 15

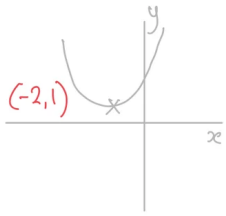
(b) Given that $c = 5$, hence, or otherwise, show that the function $f(x) = x^2 + 4x + c$ has no real roots.

DISCRIMINANT

$b^2 - 4ac < 0$

b) $(-2, c-4)$ MINIMUM

SUBSTITUTE $c = 5$ $(-2, 1)$ 5-4



MINIMUM $= (-2, 1)$

y value > 0

$\therefore$ $f(x)$ DOES NOT INTERSECT x AXIS

$\therefore$ NO REAL ROOTS

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