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

$x^2 + bx + c = \left(x + \frac{b}{2}\right)^2 - \left(\frac{b}{2}\right)^2 + c$

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

$x^2 + 6x - 7$

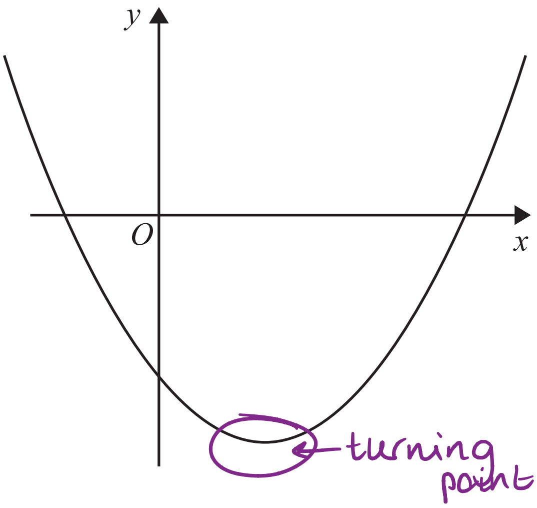
$= (x+3)^2 - 9 - 7$

$= (x+3)^2 - 16$ ✓

$(x+3)^2 - 16$ ✓

(Total for Question is 2 marks)

2. Here is a sketch of a curve.



The equation of the curve is $y = x^2 + ax + b$ where a and b are integers.

The points $(0, -5)$ and $(5, 0)$ lie on the curve.

Find the coordinates of the turning point of the curve.

$x = 0$
$y = -5$

$-5 = (0)^2 + (0)a + b$
$-5 = b$

$x = 5$
$y = 0$
$b = -5$
$0 = (5)^2 + (5)a - 5$
$0 = 20 + 5a$
$-20 = 5a$
$-4 = a$

$y = x^2 - 4x - 5$
$y = (x-2)^2 - (-2)^2 - 5$
$y = (x-2)^2 - 4 - 5$
$y = (x-2)^2 - 9$

$x = 2$
$y = 0^2 - 9$
$y = -9$
$(2, -9)$

$y = \left(x + \frac{a}{2}\right)^2 - \left(\frac{a}{2}\right)^2 + b$
where $y = x^2 + ax + b$

(2 , −9)

(Total for Question is 4 marks)

3. Given that $x^2 - 6x + 1 = (x - a)^2 - b$ for all values of x,

(i) find the value of a and the value of b.

$x^2 - 6x + 1$

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

Because $(-6) \div 2 = -3$

$= (x-3)^2 - 9 + 1$

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

$a =$ 3 1

$b =$ 8

(2)

(ii) Hence write down the coordinates of the turning point on the graph of $y = x^2 - 6x + 1$

If $y = (x+a)^2 + b$,

the turning point

$= (-a, b)$

$\therefore$ the turning point of $(x-3)^2 - 8$

$= \underline{\underline{(3, -8)}}$.

1 (3 , -8)

(1)

(Total for Question is 3 marks)

4. Sketch the graph of

$$y = 2x^2 - 8x - 5$$

showing the coordinates of the turning point and the exact coordinates of any intercepts with the coordinate axes.

Find y-intercept:

$y = ax^2 + bx + c$

c is always the y-intercept.

$y = 2x^2 - 8x - 5$

$c = -5$

(1)

$\therefore$ y-intercept $= -5$

Find turning point: (complete the square)

$2x^2 - 8x - 5 = 0$

$2[x^2 - 4x] - 5 = 0$

$2[(x-2)^2 - 4] - 5 = 0$

$2(x-2)^2 - 8 - 5 = 0$

$2(x-2)^2 - 13 = 0$

$a(x+d)^2 + e = 0$

Turning point $= (-d, e)$

(1)

Turning point $= (2, -13)$

Find x-intercepts:

$2(x-2)^2 - 13 = 0$

$2(x-2)^2 = 13$

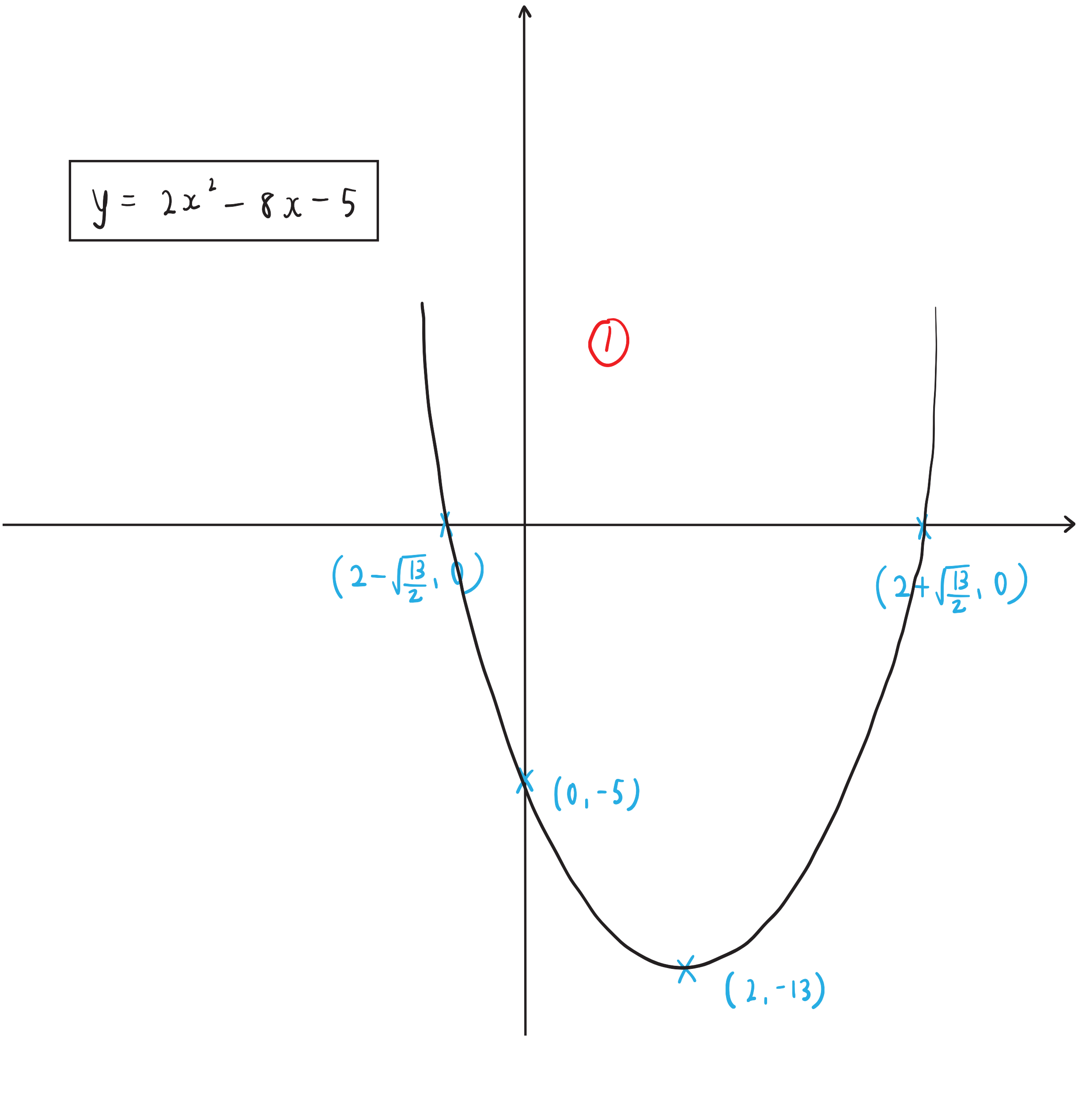
$(x-2)^2 = \frac{13}{2}$ (1)

$x - 2 = \pm\sqrt{\frac{13}{2}}$

$x = 2 \pm \sqrt{\frac{13}{2}}$ (1)

P.T.O.

(Total for Question is 5 marks)


y = 2x² − 8x − 5
1
(2 − √(13/2), 0)
(2 + √(13/2), 0)
(0, −5)
(2, −13)

5. Write down the coordinates of the turning point on the graph of $y = (x + 12)^2 - 7$

(−12 , −7)

(Total for Question is 1 mark)

6. Find the coordinates of the turning point on the curve with equation $y = 9 + 18x - 3x^2$
You must show all your working.

$y = -3x^2 + 18x + 9.$

factorise the -3:

$y = -3(x^2 - 6x) + 9.$ 1

we know that $(x^2 - 2ax) = (x-a)^2 - a^2$

$\therefore y = -3[(x-3)^2 - 9] + 9.$ 1

multiply by -3:

$y = -3(x-3)^2 + 27 + 9.$

$y = -3(x-3)^2 + 36.$ 1

If $y = (x-a)^2 + b$, T.P. is (a, b)

$\therefore$ turning point $= \underline{\underline{(3, 36)}}.$

1

(3 , 36)

(Total for Question is 4 marks)