

## Completing the Square

Using completing the square, express the following in the form  $a(x + b)^2 + c$

a)  $3x^2 - 18x - 2$

b)  $3x^2 + 12x - 8$

c)  $4p^2 - 12p + 13$

d)  $\frac{1}{2}y^2 + 3y - 4$

e)  $\frac{1}{3}v^2 - 4v + 10$

f)  $-2x^2 + 8x + 5$

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a)  $3x^2 - 18x - 2$

$$\begin{aligned} & 3(x^2 - 6x) - 2 \\ 3(x^2 - 6x + 9) - 3(9) - 2 \\ & 3(x - 3)^2 - 3(9) - 2 \\ & 3(x - 3)^2 - 29 \end{aligned}$$

b)  $3x^2 + 12x - 8$

$$\begin{aligned} & 3(x^2 + 4x) - 8 \\ & = 3(x^2 + 4x + 4) - 3(4) - 8 \\ & = 3(x + 2)^2 - 12 - 8 \\ & = 3(x + 2)^2 - 20 \end{aligned}$$

c)  $4p^2 - 12p + 13$

$$\begin{aligned} & 4(p^2 - 3p) + 13 \\ & 4\left(p^2 - 3p + \left(\frac{3}{2}\right)^2\right) - 4\left(\frac{3}{2}\right)^2 + 13 \\ & 4\left(p - \frac{3}{2}\right)^2 + 4 \end{aligned}$$

d)  $\frac{1}{2}y^2 + 3y - 4$

$$\begin{aligned} & \frac{1}{2}(y^2 + 6y) - 4 \\ & = \frac{1}{2}(y + 6y + 9) - \frac{9}{2} - 4 \\ & = \frac{1}{2}(y + 3)^2 - \frac{17}{2} \end{aligned}$$

e)  $\frac{1}{3}v^2 - 4v + 10$

$$\begin{aligned} & \frac{1}{3}(v^2 - 12v) + 10 \\ & \frac{1}{3}(v - 12v + 36) - \frac{36}{3} + 10 \\ & \frac{1}{3}(v - 6)^2 - 2 \end{aligned}$$

f)  $-2x^2 + 8x + 5$

$$\begin{aligned} & -2(x^2 - 4x) + 5 \\ & -2(x^2 - 4x + 4) - (-2)(4) + 5 \\ & -2(x - 2)^2 + 13 \end{aligned}$$