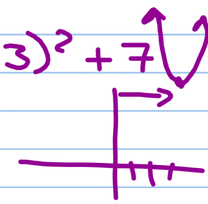
Completing the Square
(Standard form to Vertex form)

$y = ax^2 + bx + c$ ⟷ $y = a(x-p)^2 + q$

c: y-intercept

- Vertex (p, q)
- Graph using transformations
- Finding the max or min

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



- up
- $(3,7)$

min of 7

$y \geq 7$

Vertex → Standard Form

$\cancel{(x-3)^2 = x^2 + 9}$

F O

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

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

$x^2 - 6x + 9$

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

$y = 2(x-3)(x-3) + 7$

$y = 2 \cdot (x^2 - 6x + 9) + 7$

$y = 2x^2 - 12x + 18 + 7$

$y = 2x^2 - 12x + 25$

Ex2 $y = 3(x-4)^2 + 3$

$y = 3(x-4)(x-4) + 3$

$y = 3(x^2 - 8x + 16) + 3$

$y = 3x^2 - 24x + 48 + 3$

$\boxed{y = 3x^2 - 24x + 51}$

TRY THIS ON YOUR WHITEBOARD

Change to STANDARD FORM

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

$$y = -2x^2 - 12x - 24$$

$$y = -2x^2 - 12x - 24 \Rightarrow y = -2(x+3)^2 - 6$$

Do these 3:

$$(x-6)^2 = x^2 - 12x + 36$$

$$(x+7)^2 = x^2 + 14x + 49$$

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

$$(x-12)^2 = x^2 - 24x + 144$$

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

x2.

$$x^2 - 20x + 100 = (x \quad 10)^2$$

$$x^2 + 16x + 64 = (x + 8)^2$$

$$x^2 - 12x + 36 = (x - 6)^2$$

$$y=(x^2-8x)+5 \implies y=a(x-p)^2+q$$

$$y=\underbrace{(x^2-8x+16)}\underbrace{-16+5}$$

$$y=(x-4)^2-11$$

VERTEX $(4,-11)$

min of -11

$$y=(x^2+10x)-13$$

$$y=\boxed{(x^2+10x+25)}\underbrace{-25-13}$$

$10\div2=5^2$

$$y=(x+5)^2-38$$

STEPS

① Group the two x^2+x terms

② Put in pockets

③ Divide the x coefficient by 2 and square it

④ Now write in vertex form

Purple Sheet Adjustment:

Section 3.3 Change to:

#1-4, 6-8, 12

TRICKIER QUESTIONS

Ex 1: $y = x^2 - 5x + 3$

$y = \left(x^2 - 5x + \frac{25}{4}\right) - \frac{25}{4} + 3 \cdot \frac{4}{4}$

$\left(\frac{+5}{2}\right)^2$

$y = \left(x - \frac{5}{2}\right)^2 - \frac{13}{4}$

Ex 2: $y = (3x^2 - 12x) - 9$ → $y = 3(x-p)^2 + q$

① Group the terms & then factor the 3 out

$y = 3[(x^2 - 4x)] - 9$

$y = [(x^2 - 4x \quad) \quad] - 9$

$[(x - 2)^2 \quad] - 9$

$y = 3(x-2)^2 \quad - 9$

$y = 3(x-2)^2 - 21$

$y = 3(x^2 - 4x + 4) - 12 - 9$

Ex3: $y = (-5x^2 - 70x)$

$y = -5(x^2 + 14x)$

$y = -5(x^2 + 14x + 49) + 245$

(-245)

$y = -5(x+7)^2 + 245$

Check:

$y = -5(x+7)(x+7) + 245$

$y = -5(x^2 + 14x + 49) + 245$

$y = -5x^2 - 70x - 245 + 245$

$y = -5x^2 - 70x$ ☆