Vertex Form

Q.1. $y = 2(x-2)^2 - 5$

Step. 1. $a = 2,\ h = 2,\ k = -5$

Step. 2. Vertex $(h, k) \Rightarrow$ vertex $(2, -5)$, Axis of Symm $\rightarrow x = 2$

Step. 3. X-intercept

$y = 0, \Rightarrow \quad 0 = 2(x-2)^2 - 5$

$+5 \qquad +5$

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

$\frac{5}{2} = \frac{2(x-2)^2}{2}$

$2.5 = (x-2)^2$

$\pm\sqrt{2.5} = x - 2$

$\pm 1.58 = x - 2$

Therefore, $1.58 = x - 2$ | $-1.58 = x - 2$

$+2 \qquad +2$ | $+2 \qquad +2$

$3.58 = x$ | $0.42 = x$

Therefore, x-intercepts $\rightarrow (3.58, 0)$ & $(0.42, 0)$

Y-intercept

$x = 0 \rightarrow \quad y = 2(0-2)^2 - 5$

$y = 2(-2)^2 - 5$

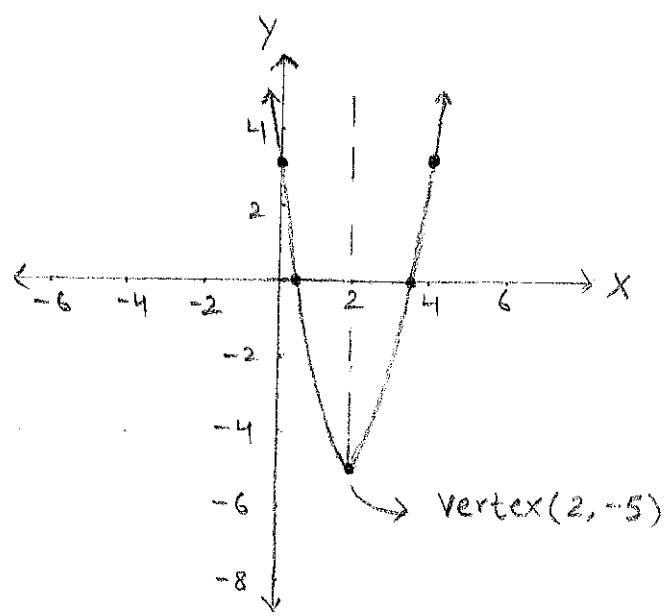
$y = 2(4) - 5$

$y = 8 - 5$

$y = 3$

Therefore, y-intercept $\rightarrow (0, 3)$

Step. 4. Graph



Zeros $\rightarrow x = 0.42, 3.58$

Axis of Symm $\rightarrow x = 2$

Q.2. $y = (x-3)^2 - 6$

Step. 1. $a = 1,\ h = 3,\ k = -6$

Step. 2. Vertex $(3, -6)$

Step. 3. x-intercept

$y = 0, \Rightarrow \quad 0 = (x-3)^2 - 6$

$+6 \qquad +6$

$6 = (x-3)^2$

$\pm\sqrt{6} = x - 3$

$\pm 2.5 = x - 3$

Therefore, $2.5 = x - 3$

$+3 \qquad +3$

$5.5 = x$

$-2.5 = x - 3$

$+3 \qquad +3$

$0.5 = x$

Therefore, x-intercepts $\rightarrow$ $(5.5, 0)$ & $(0.5, 0)$

y-intercept

$x = 0, \Rightarrow \quad y = (0-3)^2 - 6$

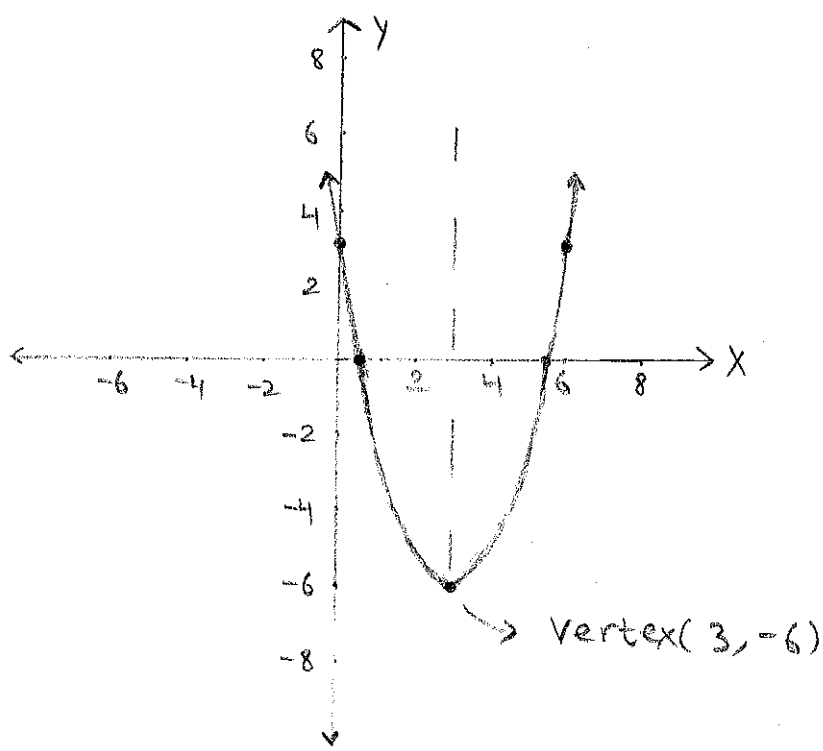
$y = (-3)^2 - 6$

$y = 9 - 6$

$y = 3$

Therefore, y-intercept $\rightarrow$ $(0, 3)$

Step. 4. Graph.



Zeros $\rightarrow$ $x = 0.5,\ 5.5$

Axis of symm $\rightarrow$ $x = 3$

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

Step.1. $a = -2,\ h = 3,\ k = 2$

Step.2. vertex $(3,2)$

Step.3. x-intercept

$y = 0,\quad 0 = -2(x-3)^2 + 2$

$-2 \qquad\qquad -2$

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

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

$1 = (x-3)^2$

$\pm\sqrt{1} = (x-3)$

$\pm 1 = x-3$

Therefore, $1 = x-3$

$+3 \quad +3$

$4 = x$

$-1 = x-3$

$+3 \quad +3$

$2 = x$

Therefore, x-intercepts $\rightarrow (4,0)$ & $(2,0)$

y-intercept

$x = 0,\quad y = -2(0-3)^2 + 2$

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

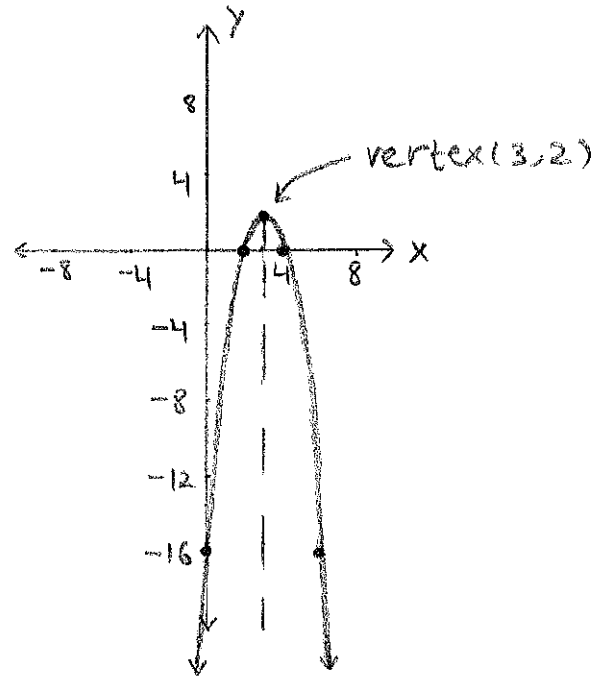
$y = -2(9) + 2$

$y = -18 + 2$

$y = -16$

Therefore, y-intercept $(0,-16)$

Step.4. Graph



Zeros $\rightarrow x = 2$ & 4

Axis of Symm $\rightarrow x = 3$

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

Step.1. $a = -3$, $h = -2$, $k = 4$

Step.2. Vertex $(-2, 4)$

Step.3. x-intercept

$y = 0$, $\Rightarrow$ $0 = -3(x+2)^2 + 4$

$-4 \qquad -4$

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

$\frac{-4}{-3} = \frac{-3(x+2)^2}{-3}$

$1.3 = (x+2)^2$

$\pm\sqrt{1.3} = x+2$

$\pm 1.14 = x+2$

Therefore, $1.14 = x+2$ | $-1.14 = x+2$

$-2 \qquad -2$ | $-2 \qquad -2$

$-0.86 = x$ | $-3.14 = x$

Therefore, x-intercepts $\rightarrow (-0.86, 0)$ & $(-3.14, 0)$

y-intercept

$x = 0$, $y = -3(0+2)^2 + 4$

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

$y = -3(4) + 4$

$y = -12 + 4$

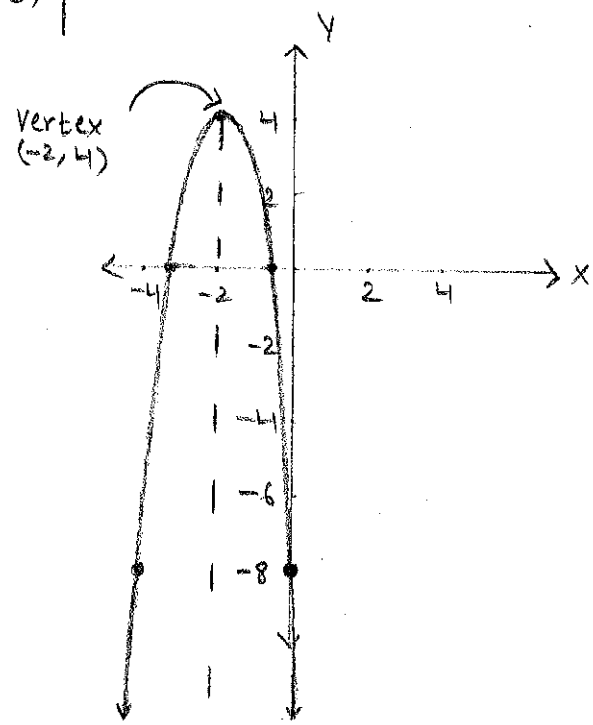
$y = -8$

Therefore, y-intercept $(0, -8)$

Step.4. Graph

Zeros $\rightarrow$ $x = -0.86, -3.14$

Axis of symm $\rightarrow$ $x = -2$



Q.5. $y = -3(x-4)^2$

Step. 1. $a = -3$, $h = 4$, $k = 0$

Step. 2. Vertex $(4, 0)$, Direction → Downwards

Step. 3. X-intercept

$y = 0$, ⇒ $0 = -3(x-4)^2$

$$\frac{0}{-3} = \frac{-3(x-4)^2}{-3}$$

$$0 = (x-4)^2$$

$$\sqrt{0} = x-4$$

$$0 = x-4$$

$$+4 \quad +4$$

$$4 = x$$

Therefore, x-intercept → $(4, 0)$

Y-intercept

$x = 0$, $y = -3(0-4)^2$

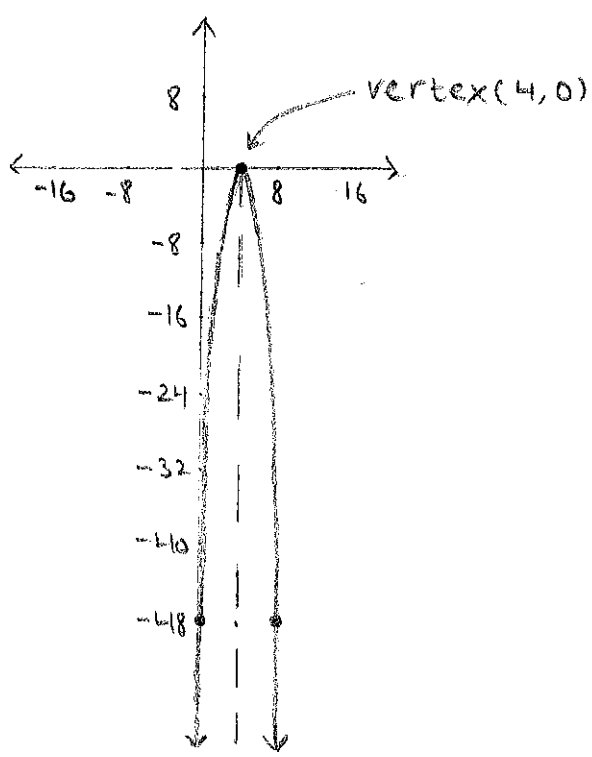
$y = -3(-4)^2$

$y = -3(16)$

$y = -48$

Therefore, y-intercept $(0, -48)$

Step. 4. Graph



Zeros → $x = 4$

Axis of Symm → $x = 4$

Q.6. $y = 2(x+3)^2$

Step. 1. $a=2$, $h=-3$, $k=0$

Step. 2. Vertex $(-3,0)$, Direction $\rightarrow$ Upwards

Step. 3. x-intercept

$y=0$, $0 = 2(x+3)^2$

$$\frac{0}{2} = \frac{2(x+3)^2}{2}$$

$$0 = (x+3)^2$$

$$\sqrt{0} = x+3$$

$$0 = x + 3$$
$$-3 \quad -3$$

$$-3 = x$$

Therefore, x-intercept $(-3,0)$

y-intercept

$x=0$, $y = 2(0+3)^2$

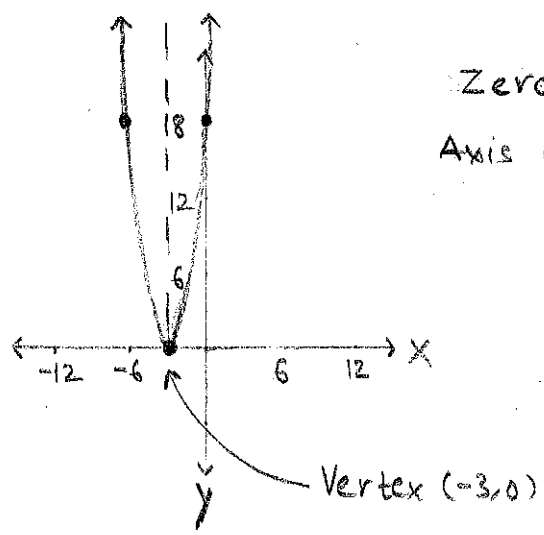
$y = 2(3)^2$

$y = 2(9)$

$y = 18$

Therefore, y-intercept $(0,18)$

Step. 4. Graph



Zeros $\rightarrow$ $x=-3$

Axis of Symm $\rightarrow$ $x=-3$

Q.7. $y = -2x^2 + 3 = -2(x+0)^2 + 3$

Step.1. $a = -2$, $h = 0$, $k = 3$

Step.2. Vertex $(0, 3)$, Direction → Downwards

Step 3. x-intercept

$y = 0$, $0 = -2x^2 + 3$

$-3 \qquad -3$

$-3 = -2x^2$

$\frac{-3}{-2} = \frac{-2x^2}{-2}$

$1.5 = x^2$

$\pm\sqrt{1.5} = x$

$\pm 1.2 = x$

Therefore, $1.2 = x$ | $-1.2 = x$

Therefore, x-intercepts → $(1.2, 0)$ & $(-1.2, 0)$

y-intercept

$x = 0$, $y = -2(0)^2 + 3$

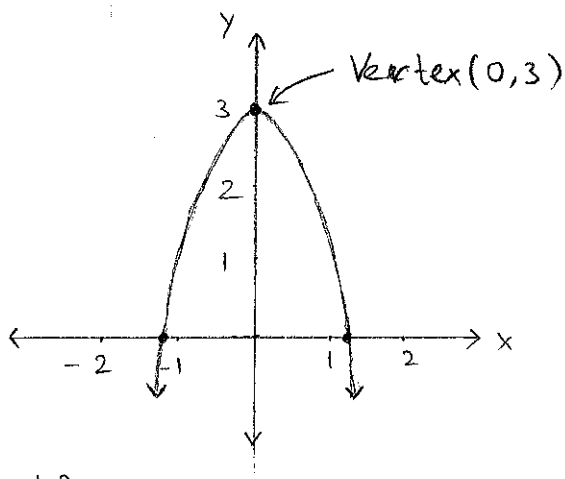
$y = -2(0) + 3$

$y = 0 + 3$

$y = 3$

Therefore, y-intercept $(3, 0)$

Step.4. Graph



Zeros → $x = -1.2, 1.2$

Axis of Symm → $x = 0$

Q.8. $y = 2(x-3)^2 + 5$

Step.1. $a = 2$, $h = 3$, $k = 5$

Step.2. Vertex $(3,5)$, Direction $\rightarrow$ Upwards

Step.3. x-intercept

$y = 0$, $0 = 2(x-3)^2 + 5$

$-5 \qquad -5$

$-5 = 2(x-3)^2$

$\frac{-5}{2} = \frac{2(x-3)^2}{2}$

$-2.5 = (x-3)^2$

$\sqrt{-2.5} = (x-3)$

Square root of a -ve number is not a real number.

Therefore, No x-intercept in this case

y-intercept

$x = 0$, $y = 2(0-3)^2 + 5$

$y = 2(-3)^2 + 5$

$y = 2(9) + 5$

$y = 18 + 5$

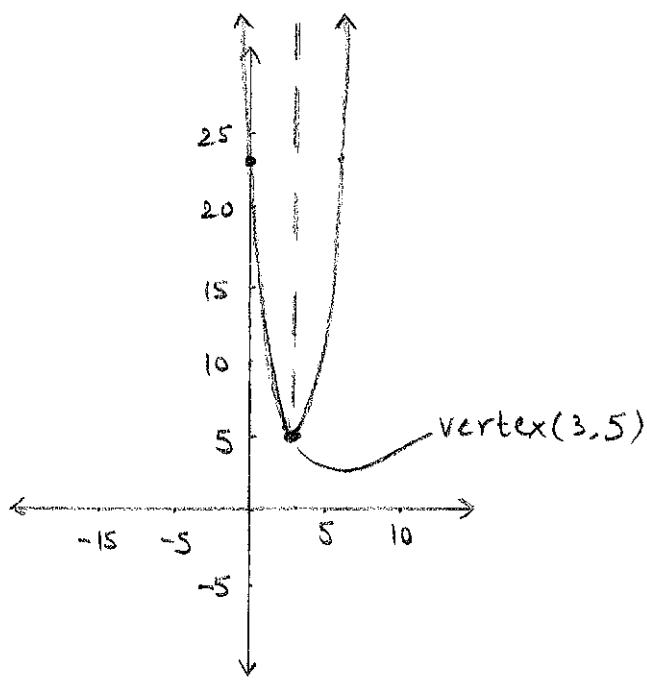
$y = 23$

Therefore, y-intercept $(0,23)$

Step.4. Graph

Zeros $\rightarrow$ None

Axis of Symm $\rightarrow$ $x = 3$



Q.9. $y = -4(x-2)^2 - 3$

Step.1. $a = -4$, $h = 2$, $k = -3$

Step.2. Vertex $(2, -3)$, Direction $\rightarrow$ Downwards

Step.3. x-intercept

$y = 0$, $0 = -4(x-2)^2 - 3$

$+3 \qquad +3$

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

$\frac{3}{-4} = \frac{-4(x-2)^2}{-4}$

$-0.7 = (x-2)^2$

$\sqrt{-0.7} = x - 2$

Square root of a -ve number is not possible.
Therefore — there is no x-intercept in this case.

y-intercept

$x = 0$, $y = -4(0-2)^2 - 3$

$y = -4(-2)^2 - 3$

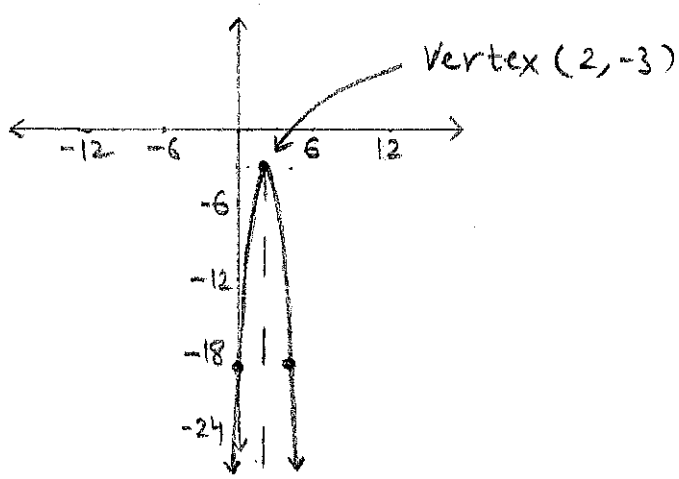
$y = -4(4) - 3$

$y = -16 - 3$

$y = -19$

Therefore, y-intercept $\rightarrow (0, -19)$

Step.4. Graph.



Zeros $\rightarrow$ None

Axis of symm. $\rightarrow x = 2$