4.2a Linear and Quadratic Functions

1314/0214 College Algebra
Brice
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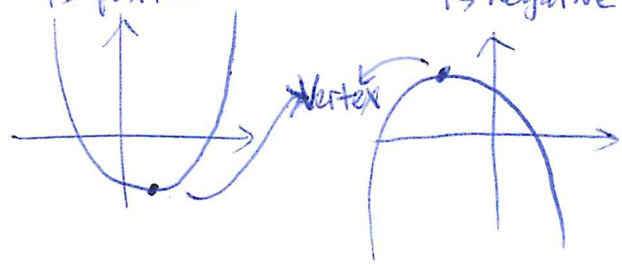
Form of expression

(1) Linear Function

$f(x) = mx + b$.



(2) Quadratic Function.

① Vertex form:

$$\boxed{f(x) = (x-h)^2 + k}$$

This gives you the vertex of the parabola, which is (h, k)

e.g. $f(x) = (x-3)^2 + 7$. vertex $(3, 7)$

$f(x) = (x+5)^2 - 3$ vertex $(-5, -3)$

$f(x) = x^2 + 6 = (x+0)^2 + 6$, vertex $(0, 6)$

$f(x) = (x-5)^2 = (x-5)^2 + 0$, vertex $(5, 0)$.

② standard form:

$$\boxed{f(x) = ax^2 + bx + c}$$

The vertex of this function is at $x = -\frac{b}{2a}$

and the corresponding y-value is $f(x)$ evaluated at $-\frac{b}{2a}$

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Hawkes Practice:

(1) Consider the following function:

$$a(x) = (4x - 18) - (-14 + 6x)$$

① Find the slope and the y-intercept.

$$a(x) = (4x - 18) - (-14 + 6x)$$

$$= 4x - 18 + 14 - 6x$$

$$= (4x - 6x) + (14 - 18)$$

$$= -2x - 4$$

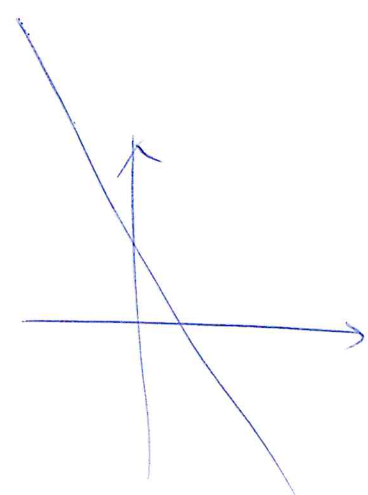
So slope is $m = -2$.

y-intercept is $(0, -4)$

② Find two points on the line to graph the function

$$a(x) = -2x - 4$$

x	y
2	$-2(2) - 4 = -8$
4	$-2(4) - 4 = -12$



So the two points to plot can be $(2, -8)$, $(4, -12)$

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12). Consider the following function.

$h(x) = (x-2)^2 - 9.$

① Find the vertex

$(2, -9)$

② Find the x-intercepts, if any.

$h(x) = (x-2)^2 - 9.$

Strategy:
- Let the function equal 0
- Solve for x.

Let $0 = (x-2)^2 - 9$

$9 = (x-2)^2$

$(x-2)^2 = 9$

$\sqrt{(x-2)^2} = \sqrt{9}$

$|x-2| = 3$

$x - 2 = \pm 3$

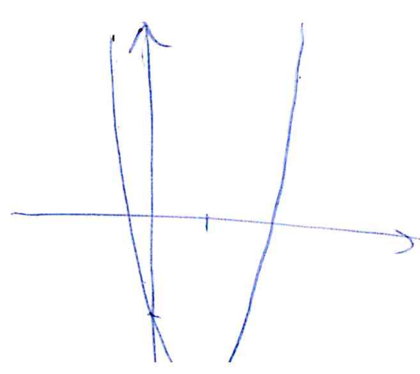
$\therefore$ either $x-2 = 3$ or $x-2 = -3$

$x = 5$ or $x = -1$

So x-intercepts are $(5,0)$ and $(-1,0)$

③ Find two points on the parabola other than the vertex and x-intercepts.

x	y
3	$(3-2)^2 - 9 = 1 - 9 = -8$
6	$(6-2)^2 - 9 = 4^2 - 9 = 16 - 9 = 7$



two points

(3) Consider the following Function.

$r(x) = x^2 + 5x + 6$.

① Find the vertex

$$x = -\frac{b}{2a} = -\frac{5}{2(1)} = -\frac{5}{2}$$

$$r(-\tfrac{5}{2}) = (-\tfrac{5}{2})^2 + 5(-\tfrac{5}{2}) + 6$$

$$= \frac{25}{4} - \frac{25}{2} + 6$$

$$= -\frac{25}{4} + 6$$

$$= -\frac{25}{4} + \frac{24}{4}$$

$$= \boxed{-\frac{1}{4}}$$

"handy-dandy method"
to add fractions (subtract)
1) multiply the denominator
2) Start in upper left and cross multiply. Keep the sign in the middle

② Find the x-intercepts, if any.

$x^2 + 5x + 6 = 0$

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

$(x+3) = 0$ or $(x+2) = 0$.

$x = -3$ or $x = -2$.

So the x-intercepts are $(-3,0)$ and $(-2,0)$

③ Find two additional points.

$r(1) = 1^2 + 5(1) + 6 = 1 + 5 + 6 = 12$ $(1,12)$

$r(-1) = (-1)^2 + 5(-1) + 6 = 1 - 5 + 6 = 2$ $(-1,2)$

$r(0) = (0)^2 + 5(0) + 6 = 6$. $(0,6)$