# MEMORIAL UNIVERSITY OF NEWFOUNDLAND

DEPARTMENT OF MATHEMATICS AND STATISTICS

SECTION 2.5 **Math 1090 Worksheet** FALL 2026

**SOLUTIONS**

1. (a) This is a quadratic function with $a = \frac{1}{2}$, $b = 0$ and $c = 1$ so the $x$-coordinate of the vertex is

$$h = -\frac{b}{2a} = -\frac{0}{2 \cdot \frac{1}{2}} = 0,$$

and the $y$-coordinate is

$$k = f(0) = \frac{1}{2} \cdot 0^2 + 1 = 1.$$

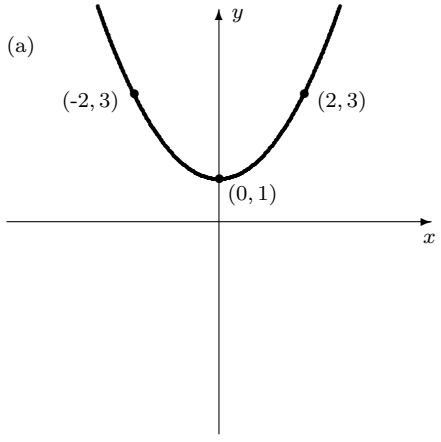
Thus the vertex is the point $(0, 1)$, which is also the $y$-intercept.
To find any $x$-intercepts, we set

$$\frac{1}{2}x^2 + 1 = 0$$
$$x^2 = -2,$$

which is impossible. This means that there are no $x$-intercepts.
We there need an addition points on either side of the vertex. For instance,

$$f(2) = \frac{1}{2}(2^2) + 1 = 3$$
$$f(-2) = \frac{1}{2}(-2)^2 + 1 = 3,$$

so $(2, 3)$ and $(-2, 3)$ are appropriate points. Lastly, we can sketch the graph.




The domain is $D = \mathbb{R}$ and the range is $R = [1, \infty)$.

(b) This is a quadratic function with $a = -1$, $b = 4$ and $c = -3$ so the $x$-coordinate of the vertex is

$$h = -\frac{b}{2a} = -\frac{4}{2 \cdot (-1)} = 2$$

and the $y$-coordinate is

$$k = f(2) = -2^2 + 4 \cdot 2 - 3 = -4 + 8 - 3 = 1.$$

Thus the vertex is the point $(2, 1)$.
We find any $x$-intercepts, by solving

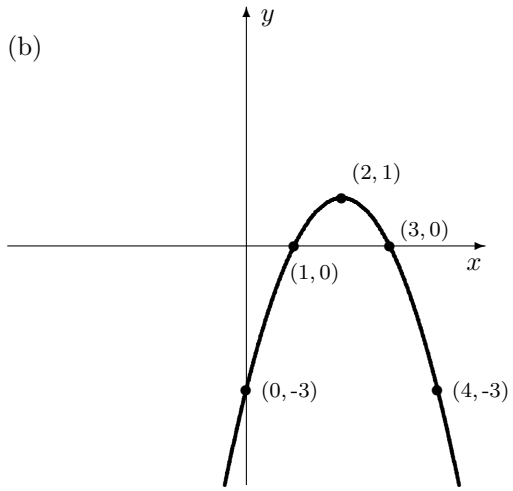
$$\begin{aligned} -x^2 + 4x - 3 &= 0 \\ -(x^2 - 4x + 3) &= 0 \\ -(x-1)(x-3) &= 0, \end{aligned}$$

so $x = 1$ or $x = 3$. Therefore the $x$-intercepts are $(1, 0)$ and $(3, 0)$.
Also,

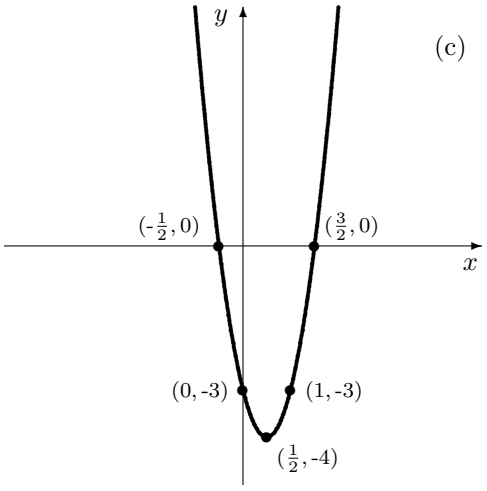
$$f(0) = -0^2 + 4 \cdot 0 - 3 = -3$$

so the $y$-intercept is $(0, -3)$. From symmetry, the point opposite the $y$-intercept on the other side of the vertex is $(4, -3)$. Now we can sketch the graph, shown below.
Note that the domain is $D = \mathbb{R}$ and the range is $R = (-\infty, 1]$.

(b)




(c)




(c) This is a quadratic function with $a = 4$, $b = -4$, $c = -3$ so the $x$-coordinate of the vertex is

$$h = -\frac{b}{2a} = -\frac{-4}{2 \cdot 4} = \frac{1}{2}$$

and the $y$-coordinate is

$$y = f\left(\frac{1}{2}\right) = 4\left(\frac{1}{2}\right)^2 - 4\left(\frac{1}{2}\right) - 3 = 1 - 2 - 3 = -4.$$

Thus the vertex of the parabola is the point $(\frac{1}{2}, -4)$.
Any $x$-intercepts are found by setting

$$4x^2 - 4x - 3 = 0$$
$$(2x - 3)(2x + 1) = 0$$

and hence $2x - 3 = 0$ so $x = \frac{3}{2}$ or $2x + 1 = 0$ so $x = -\frac{1}{2}$. Thus the $x$-intercepts are $(\frac{3}{2}, 0)$ and $(-\frac{1}{2}, 0)$.
To find the $y$-intercept, we let $x = 0$ so

$$y = 4 \cdot 0^2 - 4 \cdot 0 - 3 = -3$$

and hence the $y$-intercept is $(0, -3)$. The point opposite the $y$-intercept on the other side of the vertex is $(1, -3)$. Now we can sketch the graph, shown above.
Note that the domain is $D = \mathbb{R}$ and the range is $R = [-4, \infty)$.

(d) We can rewrite the function as

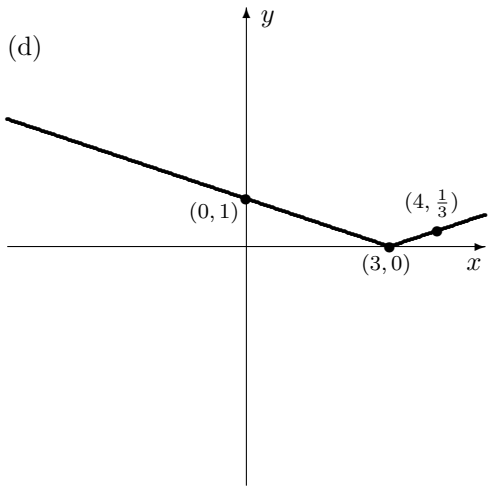
$$f(x) = \left|-\frac{1}{3}(x - 3)\right| = \left|-\frac{1}{3}\right| \cdot |x - 3| = \frac{1}{3}|x - 3|$$

so this is an absolute value function with $a = \frac{1}{3}$, $h = 3$ and $k = 0$. Thus the vertex is the point $(3, 0)$ which must also be the only $x$-intercept.
To find the $y$-intercept, we set $x = 0$ and obtain

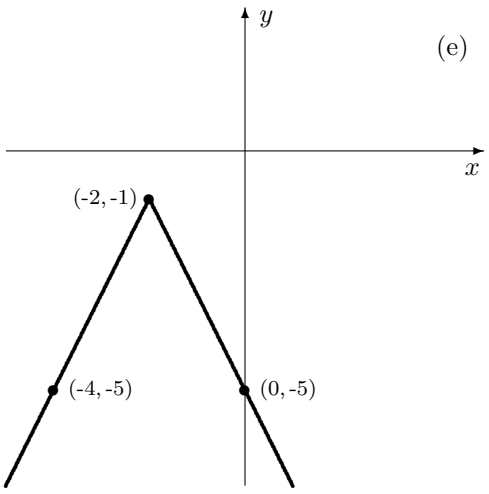
$$y = \left|1 - \frac{0}{3}\right| = |1 - 0| = |1| = 1,$$

so $(0, 1)$ is the $y$-intercept. From symmetry, the point opposite the $y$-intercept on the other side of the vertex is $(6, 1)$. Now we can sketch the graph, below.
Observe that the domain is $D = \mathbb{R}$ and the range is $R = [0, \infty)$.

(d)




(e)



(e) This is an absolute value function with $a = -2$, $h = -2$ and $k = -1$ so the vertex is the point $(-2, -1)$.

Any $x$-intercepts can be found by setting

$$\begin{aligned} -2|x+2| - 1 &= 0 \\ -2|x+2| &= 1 \\ |x+2| &= -\frac{1}{2}, \end{aligned}$$

which is impossible since an absolute value is never negative. Thus there are no solutions to this equation, and therefore there are no $x$-intercepts.

For the $y$-intercept, we calculate

$$f(0) = -2|0+2| - 1 = -2|2| - 1 = -2 \cdot 2 - 1 = -5$$

so $(0, -5)$ is the $y$-intercept. The point opposite the $y$-intercept on the other side of the vertex is $(-4, -5)$. Now we can sketch the graph, as found above.

The domain is $D = \mathbb{R}$ and the range is $R = (-\infty, -1]$.

(f) This is a square root function with $a = 1$, $h = -4$ and $k = -1$. Because the square root has the form $\sqrt{x-h}$ it opens to the right. The vertex is the point $(-4, 1)$ and the domain is $D = [-4, \infty)$.

To find the $x$-intercept, we set

$$\begin{aligned} \sqrt{x+4} + 1 &= 0 \\ \sqrt{x+4} &= -1, \end{aligned}$$

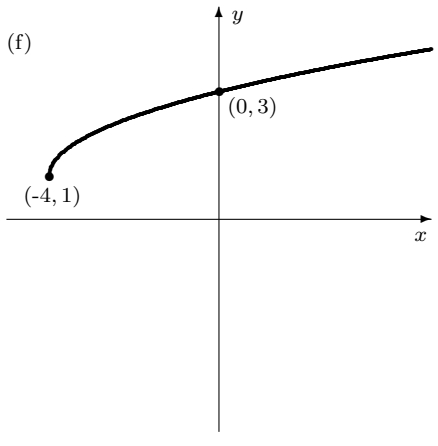
which is impossible because a square root can never be negative. Hence there is no $x$-intercept.

To determine if there is a $y$-intercept, we set $x = 0$ and obtain

$$y = \sqrt{0+4} + 1 = \sqrt{4} + 1 = 3,$$

so $(0, 3)$ is the $y$-intercept. Now we can sketch the graph, as shown below.

Note that the range is $R = [1, \infty)$.



(g) We rewrite the given equation as

$$y = -4\sqrt{x} + 3$$

and see that this is a square root function with $a = -4$, $h = 0$ and $k = 3$. Since the square root is of the form $\sqrt{x-h}$ the semi-parabola opens to the right. The vertex is the point $(0, 3)$, which is also the $y$-intercept. The domain is $D = [0, \infty)$.

The $x$-intercept can be found by setting

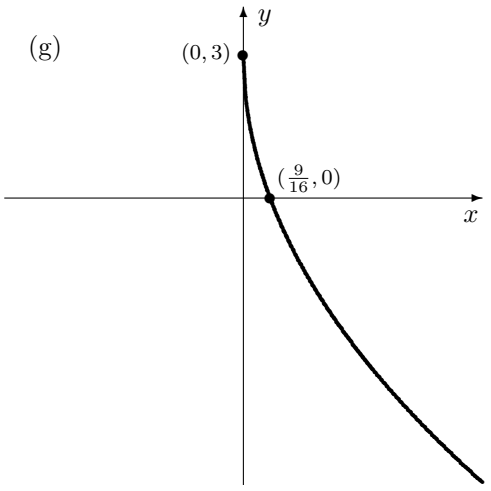
$$\begin{aligned} -4\sqrt{x} + 3 &= 0 \\ 3 &= 4\sqrt{x} \\ \frac{3}{4} &= \sqrt{x} \\ \left(\frac{3}{4}\right)^2 &= x \\ \frac{9}{16} &= x. \end{aligned}$$

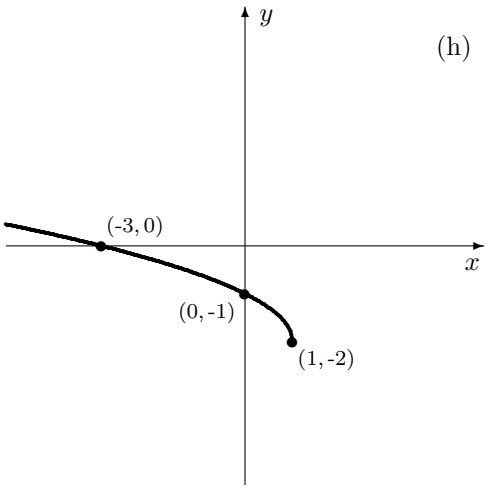
Observe that

$$-4\sqrt{\frac{9}{16}} + 3 = -4 \cdot \frac{3}{4} + 3 = -3 + 3 = 0,$$

so this is a solution of the equation. Thus $\left(\frac{9}{16}, 0\right)$ is the $x$-intercept. Now we can sketch the graph, below.

We see that the range is $R = (-\infty, 3]$.




(h) This is a square root function with $a = 1$, $h = 1$ and $k = -2$. Since the square root is of the form $\sqrt{h-x}$ the semi-parabola must open to the left. The vertex is the point $(1, -2)$ and the domain is $D = (-\infty, 1]$.

To find the $x$-intercept, we solve

$$\begin{aligned}\sqrt{1-x}-2&=0\\ \sqrt{1-x}&=2\\ 1-x&=2^2\\ 1-x&=4\\ -x&=3\\ x&=-3.\end{aligned}$$

Note that

$$\sqrt{1-(-3)}-2=\sqrt{4}-2=2-2=0,$$

so $(-3,0)$ is the $x$-intercept.
To find the $y$-intercept, we observe that

$$f(0)=\sqrt{1-0}-2=1-2=-1,$$

so $(0,-1)$ is the $y$-intercept. Now we can sketch the graph, above.
We see that the range is $R=[-2,\infty)$.