Objective: Use Vertex Form to solve problems in context.

Solve without graphing. Round to the nearest hundredth if necessary.

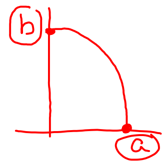
Ex) A rock is knocked off a cliff into a river. The function $h(t) = -16t^2 + 40$ models the height of the rock, in feet, after t seconds.

vertex form

a) When will the rock hit the surface of the water?

time? $h(t)$ height

$t = ?$ when $h(t) = 0$ ft



$h(t) = -16t^2 + 40$

$0 = -16t^2 + 40$

$+16t^2 \quad +16t^2$

$\frac{16t^2}{16} = \frac{40}{16}$

$t^2 = \frac{40}{16}$

$\sqrt{t^2} = \pm\sqrt{\frac{40}{16}}$

$t = -\sqrt{\frac{40}{16}}, \quad t = \sqrt{\frac{40}{16}}$

2nd $\sqrt{\ }(40 \div 16) =$

$t \approx \cancel{-1.58}$ sec $\quad t \approx 1.58$ sec

no negative time

The rock hits the surface of the water after about 1.58 seconds.

b) What is the rock's maximum height and when does it reach this height?

vertex $= (h, k) = (t, h(t))$

$h(t) = -16t^2 + 40$ vertex form

$h(t) = -16(t-0)^2 + 40$

vertex $= (0, 40)$ sec, feet

The rock's maximum height is 40 feet when it is knocked off the cliff.

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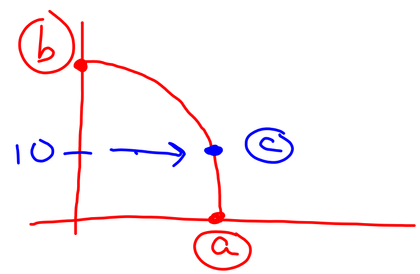
Ex) A rock is knocked off a cliff into a river. The function $h(t) = -16t^2 + 40$ models the height of the rock, in feet, after t seconds.

time

c) When will the rock reach a height of 10 feet?

$h(t)$

$t = ?$ when $h(t) = 10$ feet



$h(t) = -16t^2 + 40$

$10 = -16t^2 + 40$

$+16t^2 - 10 \qquad +16t^2 - 10$

$\frac{16t^2}{16} = \frac{30}{16}$

$t^2 = \frac{30}{16}$

$\sqrt{t^2} = \pm\sqrt{\frac{30}{16}}$

$t = -\sqrt{\frac{30}{16}}$, $t = \sqrt{\frac{30}{16}}$

~~$t \approx -1.37$ sec.~~ $t \approx 1.37$ sec

no negative time

The rock will reach a height of about 1.37 seconds.

Objective: Use Vertex Form to solve problems in context.

Solve without graphing. Round to the nearest hundredth if necessary.

Ex) The height, in feet, of a baseball hit toward left field can be modeled by the function $h(x) = -0.05(x-25)^2 + 35$, where x is the horizontal distance traveled, in feet.

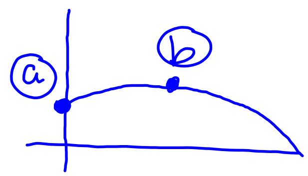
vertex form

a) What is the baseball's height when it is hit?

h(x) x

$h(x) = ?$ when

$x = 0$ feet



$h(0) = -0.05(0-25)^2 + 35$

$= 3.75$ feet

height

The baseball's height is 3.75 feet when it is hit.

b) What is the maximum height the baseball will reach and when does it reach this height?

vertex $= (h, k) = (x, h(x))$

vertex $= (25, 35)$

ft ft

horiz. dist. max height

The maximum height of the baseball is 35 feet after traveling 25 feet horizontally.

Objective: Use Vertex Form to solve problems in context.

Solve without graphing. Round to the nearest hundredth if necessary.

Ex) The height, in feet, of a baseball hit toward left field can be modeled by the function $h(x) = -0.05(x - 25)^2 + 35$, where x is the horizontal distance traveled, in feet.

c) How far will the ball have traveled horizontally when it is 8 feet above the ground?

height

$x = ?$ when $h(x) = 8$ ft

$h(x) = -0.05(x-25)^2 + 35$

$8 = -0.05(x-25)^2 + 35$

$-35 \qquad -35$

$\frac{-27}{-0.05} = \frac{-0.05(x-25)^2}{-0.05}$

$540 = (x-25)^2$

$\pm\sqrt{540} = \sqrt{(x-25)^2}$

$\pm\sqrt{540} = x - \cancel{25}$

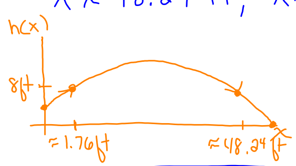
$+25 \qquad \cancel{+25}$

$x = 25 \pm \sqrt{540}$

$x = 25 + \sqrt{540}$, $x = 25 - \sqrt{540}$

$25 +$ 2nd $\sqrt{}(540) =$

$x \approx 48.24$ ft, $x \approx 1.76$ ft



The baseball is at a height of 8 feet after traveling about 1.76 feet horizontally and again after traveling about 48.24 feet.

d) How far has the ball traveled when it hits the ground?

height = 0

$x = ?$ when $h(x) = 0$ feet

$0 = -0.05(x-25)^2 + 35$

$-35 \qquad -35$

$\frac{-35}{-0.05} = \frac{-0.05 \cdot (x-25)^2}{-0.05}$

$700 = (x-25)^2$

$\pm\sqrt{700} = \sqrt{(x-25)^2}$

$\pm\sqrt{700} = x - 25$

$+25 \qquad +25$

$x = 25 \pm \sqrt{700}$

$x = 25 + \sqrt{700}$, $x = 25 - \sqrt{700}$

$x \approx 51.46$ ft $\quad x \approx \cancel{-1.46}$ ft

no neg. ft

The baseball has traveled about 51.46 feet when it hits the ground.

Objective: Use Vertex Form to solve problems in context.

Closure

The height of a rocket, in feet, t seconds after being launched can be modeled by the function $h(t) = -16(t - 5.2)^2 + 437$. In what type of problem would you solve $h(t) = 0$ and in what type of problem would you solve $h(0) = ?$.

You would solve $h(t) = 0$ to find when the rocket hit the ground. You would solve $h(0) = ?$ to find the height of the rocket when it was launched.