

DO NOW

Six times the square of a number decreased by 5 times the number equals 1. Find the negative solution.

$$\begin{aligned} \text{let } x &= \text{number} \\ 6x^2 - 5x &= 1 \\ 6x^2 - 5x - 1 &= 0 \\ (6x+1)(x-1) &= 0 \\ 6x+1=0 \text{ or } x-1=0 \\ 6x &= -1 & x &= 1 \\ x &= -\frac{1}{6} & & \uparrow \\ & & & \text{reject} \\ & & & \text{positive} \end{aligned}$$

The negative solution is $-\frac{1}{6}$.

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8.9 Modeling with Quadratic Equations

Word Problems with quadratic equations

★ Refer to section 8.3 Word Problems

height problems:

Basic form: $h(t) = -16t^2 + vt + h$

1. Asked for when it reaches maximum height
↳ find the axis of symmetry

$$t = -\frac{b}{2a}$$

2. Asked for maximum height
↳ find the y-value of the turning point
★ Plug above t into equation

3. Asked when it reaches the ground. (height=0)
↳ set equation equal to 0.

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1. An object is launched straight up in the air with an initial velocity of 32 feet per second from a roof 48 feet high. Use the function:

$$h(t) = -16t^2 + 32t + 48$$

- a. After how many seconds will it reach the maximum height?

$$\begin{aligned} t &= -\frac{b}{2a} \\ t &= -\frac{32}{2(-16)} & t &= 1 \\ t &= \frac{32}{32} \end{aligned}$$

It will reach the maximum height after 1 second.

- b. What will be the maximum height?

$$\begin{aligned} h(1) &= -16(1)^2 + 32(1) + 48 \\ h(1) &= -16 + 32 + 48 \\ h(1) &= 16 + 48 \\ h(1) &= 64 \end{aligned}$$

The maximum height is 64 feet.

- c. When will it hit the ground?

$$\begin{aligned} 0 &= -16t^2 + 32t + 48 \\ 16t^2 - 32t - 48 &= 0 \\ 16(t^2 - 2t - 3) &= 0 \\ 16(t+1)(t-3) &= 0 \\ 16 \neq 0 & \quad t+1=0 \text{ or } t-3=0 \\ & \rightarrow t=-1 & t &= 3 \end{aligned}$$

It hit the ground after 3 seconds.

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2. A football is kicked upward from ground level with an initial velocity of 32 feet per second. The following function gives the height of the ball in feet after t seconds.

$$h(t) = -16t^2 + 32t$$

- a. What is the maximum height reached by the football?

$$\begin{aligned} t &= -\frac{b}{2a} & h(1) &= -16(1)^2 + 32(1) \\ t &= -\frac{32}{2(-16)} & h(1) &= -16 + 32 \\ t &= \frac{32}{32} & h(1) &= 16 \end{aligned}$$

The maximum height is 16 feet.

- b. After how many seconds does the ball touch the ground?

$$\begin{aligned} 0 &= -16t^2 + 32t \\ 16t^2 - 32t &= 0 \\ 16t(t-2) &= 0 \\ 16t=0 \text{ or } t-2=0 \\ t=0 & \quad t=2 \end{aligned}$$

It touches the ground after 2 seconds.

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HOMEWORK

Worksheet - HW 8.9

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