36A

QUADRATIC WORD PROBLEMS
PROJECTILE MOTION

Name Answer

period ____

RESOURCES: Two Web Sites - include examples and explanations:

1) http://www.purplemath.com/modules/quadprob.htm
2) http://www.algebralab.org/Word/Word.aspx?file=Algebra_MaxMinProjectiles.xml

PROJECTILE: an object thrown, shot, or dropped. Usually straight up, or straight down.

Ask: why is it negative??

These problems use a **FUNCTION** that represents the object's height which depends on

1. The force of gravity pulling it back down (always -16 when dealing with ft/sec, and on the squared term)
2. The initial velocity (v_0) at which it was thrown/dropped (always goes with the middle term)
3. The initial height (s_0) from which it was thrown/dropped

(Max)

→ down = negative

↓ upwards = positive

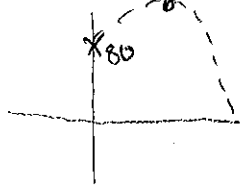
$$s(t) = -16t^2 + v_0t + s_0$$

(starting pt = c)

- t represents time (usually in seconds). It is what we're usually trying to solve for!

Examples: - Together -

A) An object is launched directly upward at 64 feet per second from a platform 80 feet high. Write the function for the height of this object at any given time (t seconds)



s(t) = $-16t^2 + 64t + 80$

When will the object reach it's maximum height? (What is this really asking?)

$x = -b/2a = -64/2(-16) = -64/-32 = 2$

$y = -16(2)^2 + 64(2) + 80$

$\therefore -64 + 128 + 80$

144 ft

What will that maximum height be? (What is this really asking?)

At 2 seconds

B) A baseball is thrown straight up in the air with an initial velocity of 29 feet per second from a point exactly 6 feet off the ground. Write the function for the height of this object at any time (t seconds)

s(t) = $-16t^2 + 29t + 6$ $\quad -(16t^2 - 29 - 6)$

-96

-32 3

29

When will this object return and hit the ground? (What is this really asking?)

After 2 seconds

$(16t - 32)(16t + 3) = 0$

$\frac{16t}{16} = \frac{32}{16}$

$t = 2$

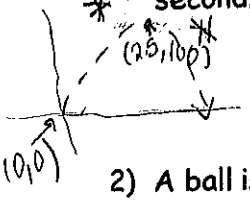
$16t = -3$

can't hit at negative time

Draw Picture with each (sketch graph)

PROBLEMS: - Use separate paper to work out these problems.

1) Some fireworks are fired vertically into the air from the ground at an initial velocity of 80 feet per second. Find the highest point reached by the firework - just as it explodes.

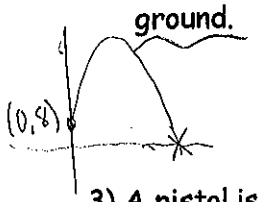


100 feet

$y = -16x^2 + 80x$

$-b/2a = -80/2(-16) = 2.5$ sec.

2) A ball is thrown vertically upward with an initial velocity of 48 feet per second. If the ball started from a height of 8 feet off the ground, determine the time it will take for the ball to hit the ground.



$-16x^2 + 48x + 8$

3.16 seconds

3) A pistol is accidentally discharged vertically upward from a height of 3 feet above the ground. If the bullet has an initial velocity of 200 feet per second, what maximum height will it reach before it starts to fall back down to the ground?

$y = -16x^2 + 200x + 3$

$x = -b/2a = -200/2(-16) = 6.25$

$y = -16(6.25)^2 + 200(6.25) + 3$

$y =$ 628 ft

4) A tennis ball is propelled upward from the face of a racket at 40 feet per second. The racket face is 3 feet above ground when it makes contact with the ball. At what time will the ball be at its highest point? How high is that highest point?

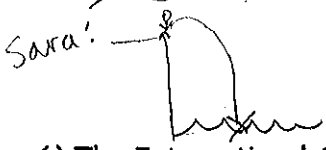
$y = -16x^2 + 40x + 3$

$-b/2a = -40/2(-16) =$ 1.25 seconds

$-16(1.25)^2 + 40(1.25) + 3 =$ 28 ft above ground

5) Sam and Sara have taken their math textbooks to the top of a twelve-story building and look at the pool which is 160 straight below them. Sam just lets go of his book, while Sara throws her book down with an initial velocity of 48 feet per second. How many seconds does it take each book to hit the water?

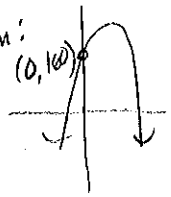
Sara:



$y = -16x^2 - 48x + 160$

Hits water after 2 seconds

Sam:



zero velocity

$-16x^2 + 0 + 160$

$-16x^2 + 160$

3.16 sec

6) The International Space Agency has finally landed a robotic explorer on an extra-solar planet. To demonstrate the crushing weight of gravity on this planet, the camera is aimed at a probe's ground-level ejection port which launches a baseball directly upwards at 147 feet per second. The force due to gravity on this planet is "98 ft/s²" (use 98 for "g" in the equation). Assuming no winds and that the probe can move out of the way in time, how long will it take the ball to smack back down to the surface of this planet?

Actually ½ of 98 = 49 (in technical terms)

$+98x^2 + 147x$

$-49x(2x - 3)$

$-49x = 0$

$2x - 3 = 0$

$2x = 3$

$x = 3/2$

It takes 1.5 seconds

Not shown:
your sketches
(8 of them)
included in
your
portfolio