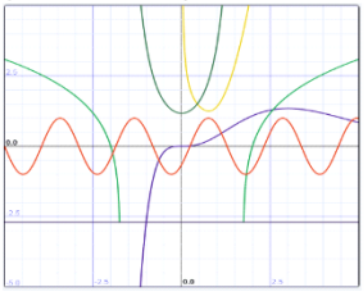
Lesson 10 More Word Problems

Date:

Chapter 4: Linear and Quadratic Functions:



Lesson 10:

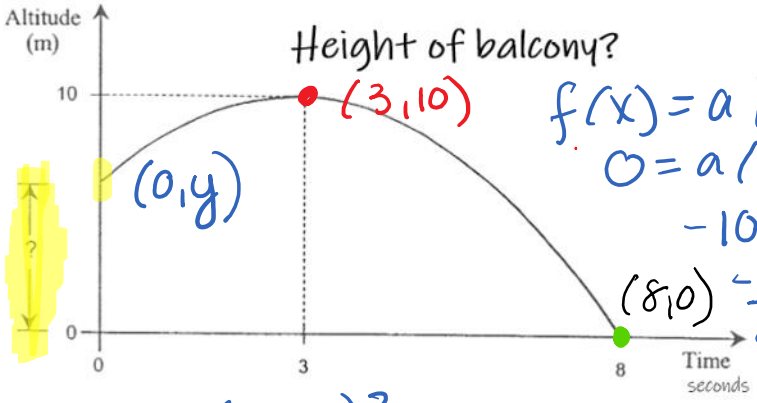
More Word Problems

Find RULE

- Projectile off a balcony.
- Reaches max after 3 seconds
- Lands after 8 seconds

(1)

Height of balcony?



$f(x) = a(x-h)^2 + k$

$0 = a(8-3)^2 + 10$

$-10 = a(25)$

$\frac{-10}{25} = a$

$a = -.4$

$f(x) = -.4(x-3)^2 + 10$

$f(0) = -.4(0-3)^2 + 10 = 6.4$

∴ Balcony is 6.4m

(2)

Darnell tosses an apple straight up in the air to a friend standing on the second floor in the main foyer. The height of the apple in feet after t seconds is:

$$h(t) = -16t^2 + 35t + 5$$

a) If Darnell's friend is 25 feet above the first floor will he be able to catch the apple? **No**, max height is $\frac{1545}{64}$ ≈ 24.14 m

b) If Darnell does not catch it, when will the apple hit the ground?

a) Find Vertex

$h(t) = -16t^2 + 35t + 5$

$= -16\left(t^2 - \frac{35}{16}t\right) + 5$

$= -16\left(t^2 - \frac{35}{16}t + \frac{1225}{1024} - \frac{1225}{1024}\right) + 5$

$= -16\left(t - \frac{35}{32}\right)^2 + 5 + \frac{1225}{64}$

$= -16\left(t - \frac{35}{32}\right)^2 + \frac{320}{64} + \frac{1225}{64}$

$= -16\left(t - \frac{35}{32}\right)^2 + \frac{1545}{64}$

b) Find zero

$-16\left(t - \frac{35}{32}\right)^2 + \frac{1545}{64} = 0$

$\left(t - \frac{35}{32}\right)^2 = \frac{-1545}{64} \cdot \frac{-1}{16}$

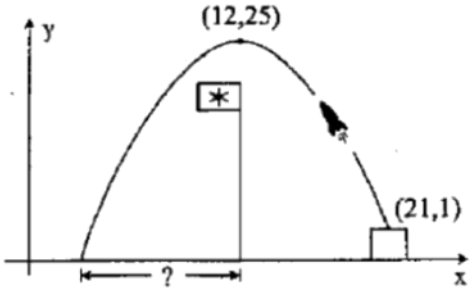
$t - \frac{35}{32} = \pm\sqrt{1.50879}$

$t = \pm 1.2283 + \frac{35}{32}$

$t_1 = -0.135$ not for time

$t_2 = 2.322$

A toy rocket ship is launched from a platform. It flies over a flagpole and lands on the ground on the other side. A graph of the situation, scaled in meters, is shown on the Cartesian plane below. The path of flight of the rocket forms a parabola. (3)



To the nearest tenth of a metre, how far from the base of the flagpole does the rocket land on the ground?

(1) RULE

$y = a(x-12)^2 + 25$

$1 = a(21-12)^2 + 25$

$-24 = a \cdot 81$

$\frac{-24}{81} = a$

(2) $f(x) = \frac{-24}{81}(x-12)^2 + 25$

let $f(x) = 0$ $\quad (x-12)^2 = 84.375$

$x - 12 = \pm 9.1856$

$x = 9.19 + 12$ $\quad x = -9.19 + 12$

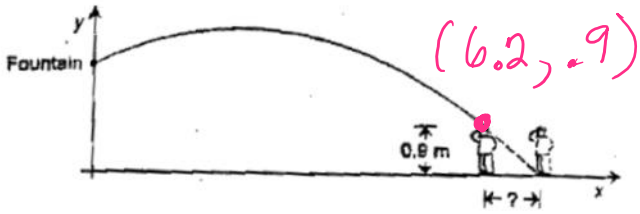
$= 21.19$ (wrong side of vertex) $\quad = 2.81$ ✓

$\therefore$ $12 - 2.81 = 9.19$ m

The stream of water coming out of a fountain lands on a child's head. The child's height is 0.9 m.

The child wants to move so that the stream of water will land at his feet.

The trajectory of the stream of water is represented in the following Cartesian plane. The scale of this graph is in metres.



The rule $f(x) = -0.1(x-2.2)^2 + 2.5$ represents the trajectory of the stream of water.

What distance must the child move so that the stream of water will land at his feet?

Show all your work.

① $f(x) = .9$

$.9 = -.1(x-2.2)^2 + 2.5$

$16 = (x-2.2)^2$

$\pm 4 = x - 2.2$

$x_1 = 4 + 2.2$ $\quad x_2 = -4 + 2.2$

$x = 6.2$ $\quad x = -1.8$ reject

(6.2, .9)

② zero

$-.1(x-2.2)^2 + 2.5 = 0$

$(x-2.2)^2 = 25$

$x - 2.2 = \pm 5$

$x = 5 + 2.2$ $\quad x = -5 + 2.2$

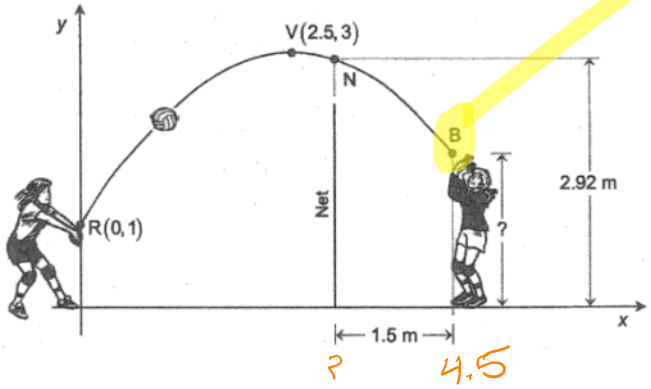
$x_1 = 7.2$ $\quad x_2 = -2.8$ reject according to diagram

he must move from 6.2 m to 7.2 m

so 1 meter

Volleyball "bump" is parabolic

At what height is the ball received at B?



RULE

(1) $f(x) = a(x-2.5)^2 + 3$

$1 = a(0-2.5)^2 + 3$

$-2 = a(6.25)$

$-.32 = a$

(2) $f(x) = 2.92$

$f(x) = -.32(x-2.5)^2 + 3$

$2.92 = -.32(x-2.5)^2 + 3$

$.25 = (x-2.5)^2$

$\pm .5 = x - 2.5$

$x_1 = .5 + 2.5$ $\quad x_2 = -.5 + 2.5$

$= 3$ $\quad = 2$ reject by diagram

(3) $3 + 1.5 = 4.5$

find

$f(4.5) = -.32(4.5-2.5)^2 + 3$

$= 1.72$

received at 1.72 m

Be organized!

Pattern is evident. What is function f_5?

Pattern is evident. What is function f_5?

Function f_1	The rule of function f_1 is $f_1(x) = -2(x-1)^2 + 18$.
Function f_2	The zeros of function f_2 are -1 and 5. In addition, $f_2(0) = 10$. $(0, 10)$
Function f_3	$f_3(1) = 10$, $f_3(3) = 18$ and $f_3(5) = 10$.
Function f_4	The rule of function f_4 is $f_4(x) = -2x^2 + 16x - 14$.
Function f_5	?

- to find pattern → all must be in the same form

$f_2 = a(x+1)(x-5)$

$10 = a(0+1)(0-5)$

$10 = a(-5)$

$a = -2$

vertex $\frac{-1+5}{2} = \frac{4}{2} = 2$

$f(x) = -2(2+1)(2-5)$

$= -2(3)(-3)$

$= 18$

$f_2 = -2(x-2)^2 + 18$

f_3

x	f(x)	
1	10	
3	18	VERTEX
5	10	

$f(x) = a(x-3)^2 + 18$

$10 = a(1-3)^2 + 18$

$10 - 18 = a(-2)^2$

$-8 = 4a$

$a = -2$

$f_3 = -2(x-3)^2 + 18$

$f_4 = -2x^2 + 16x - 14$

$= -2(x^2 - 8x \quad) - 14$

$= -2(x^2 - 8x + 16 - 16) - 14$

$= -2(x-4)^2 - 14 + 32$

$f_4 = -2(x-4)^2 + 18$

$f_1 = -2(x-1)^2 + 18$ h+1

$f_2 = -2(x-2)^2 + 18$

$f_3 = -2(x-3)^2 + 18$

$f_4 = -2(x-4)^2 + 18$

$f_5 = -2(x-5)^2 + 18$

you can now do:

WB

Page 110 and 111 # 9, 10, 12, 14, 16-18