november 14, 2007

Word Problems

Ex 1: The height of an object can be modelled by $h(t) = -2t^2 + 5t + 1$ where t is in seconds and h in meters

a) What is height after 2 seconds? $t = 2$

$$h(2) = -2(2)^2 + 5(2) + 1$$
$$h(2) = -2(4) + 10 + 1$$
$$h(2) = -8 + 10 + 1$$
$$h(2) = 3$$

b) What is max height?

$$y = -2t^2 + 5t + 1$$
$$y = -2t^2 + 5t + 1$$
$$y = -2(t^2 - \tfrac{5}{2}t\ \ ) + 1$$
$$y = -2(t^2 - \tfrac{5}{2}t + \tfrac{25}{16}) + 1 + \tfrac{25}{8}$$
$$y = -2(t - \tfrac{5}{4})^2 + \tfrac{33}{8}$$

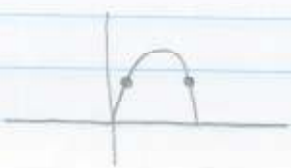
max height = $\tfrac{33}{8}$ m

c) Where was it 4m above the ground?

$$4 = -2(t - \tfrac{5}{4})^2 + \tfrac{33}{8}$$
$$4 - \tfrac{33}{8} = -2(t - \tfrac{5}{4})^2$$
$$-\tfrac{1}{8} = -2(t - \tfrac{5}{4})^2$$
$$\tfrac{1}{16} = (t - \tfrac{5}{4})^2$$

$\tfrac{1}{4} = t - \tfrac{5}{4} \rightarrow t = \tfrac{3}{2}$ s

$-\tfrac{1}{4} = t - \tfrac{5}{4} \rightarrow t = 1$ s



d) How long was it in the air?

$$0 = -2(t - 5/4)^2 + 33/8$$

$$-33/8 = -2(t - 5/4)^2$$

$$33/16 = (t - 5/4)^2$$

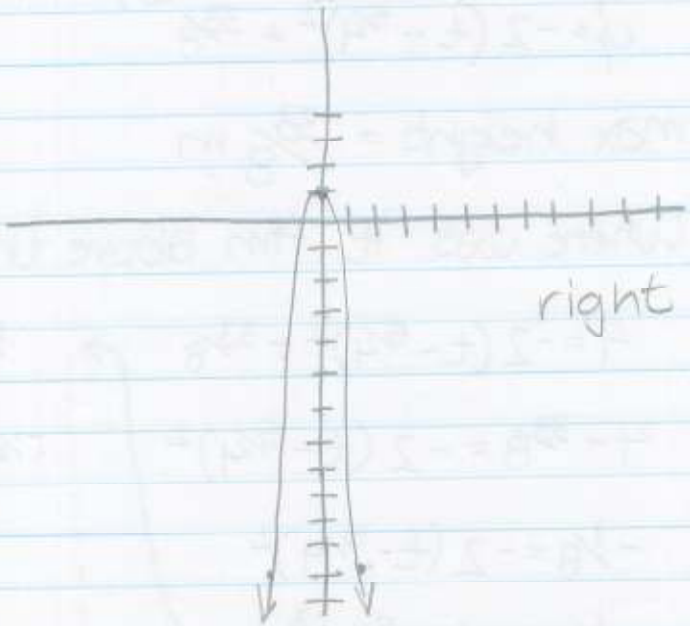
$$1.4 = t - 5/4 \rightarrow t = 2.65$$

$$-1.4 = t - 5/4 \rightarrow t = -0.15$$

Ex. 2: $C = 6x - 12x^2$

a) Graph (complete square)

$$y = -12x^2 + 6x$$
$$y = -12(x - \tfrac{1}{2}x)$$
$$y = -12(x^2 - \tfrac{1}{2}x + 1/16) + 3/4$$
$$y = -12(x - 1/4)^2 + 3/4$$



right 1, down 12

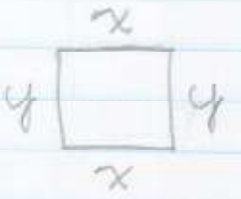
b) For what value of x will C be max

$\frac{1}{4} \rightarrow x = 0.25$

c) What is maximum

$\frac{3}{4} \rightarrow 0.75$

Ex 3: A rectangle field is to be enclosed by 300m. Find dimensions to <u>maximum area</u>



$A = xy$
$A = x(-x + 150)$
$A = -x^2 + 150x$

$2x + 2y = 300$
$2y = -2x + 300$
$y = -x + 150$

$y = -12x^2 + 6x$
$y = -12(x^2 - \frac{1}{2}x\ )$
$y = -12(x^2 - \frac{1}{2}x + \frac{1}{16}) + \frac{3}{4}$

$y = -12(x - \frac{1}{4})^2 + \frac{3}{4}$

$A = -x^2 + 150x$
$A = -(x^2 - 150x\ )$
$A = -(x^2 - 150x + 5625) + 5625$
$A = -(x - 75)^2 + 5625$

$x = 75$

$y = -x + 150$
$y = -75 + 150$
$y = 75$

$\therefore$ 75m x 75m

november 16th, 2007

Word Problems

Ex 1: The sum of 2 #'s have a difference of 16. Find #'s so product is minimum.

$P = xy$

$x - y = 16$

$x = y + 16$

$P = xy$

$P = (y + 16)y$

$P = y^2 + 16y$

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

$P = (y + 8)^2 - 64$

MINIMUM $y = -8$

$\therefore y = -8 \quad x = 8$

Ex 2: Two # differ by 21. Find #'s if result of adding sum to product is minimum

$x - y = 21$

$P = xy + x + y$

product sum

$P = (21 + y)y + 21 + y + y$

$P = 21y + y^2 + 21 + y + y$

$P = y^2 + 23y + 21$

$P = (y^2 + 23y \quad) + 21$

$P = (y^2 + 23y + 529/4) + 21 - 529/4$

$P = (y + 23/2)^2 - 445/4$

$\therefore y = -23/2 \quad x = 19/2$

Hilary

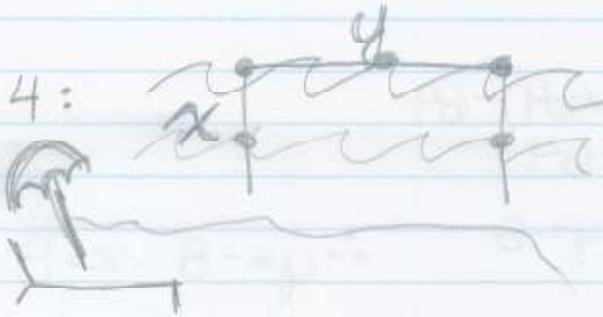
Ex 3: Two #s differ by 21. Find # if sum of squares is minimum.

$x - y = 21$
$x = 21 + y$
$P = x^2 + y^2$

$P = (21+y)^2 + y^2$
$P = y^2 + 42y + 441 + y^2$
$P = 2y^2 + 42y + 441$
$P = 2(y^2 + 21y\ \ ) + 441$
$P = 2(y^2 + 21y + 441/4) + 441 - 441/2$
$P = 2(y + 21/2)^2 + 441/2$

$\therefore y = -21/2 \quad x = 21 - 21/2$
$x = 21/2$

Ex 4:



$A = xy$
$300 = 2x + y$
$y = 300 - 2x$
$\therefore A = x(300 - 2x)$

$A = 300x - 2x^2$
$A = -2x^2 + 300$
$A = -2(x^2 - 150x + 5625) + 11250$
$A = -2(x - 75)^2 + 11250$

$\therefore x = 75$ ft.
$y = 300 - 2x$
$y = 300 - 150$
$y = 150$ ft

75ft by 150 ft