## Solving Problems Using Quadratic Relations

What we have learned that we will be using:

x-intercepts
zeroes
solutions

- factoring and the quadratic formula leads to the roots

- finding the vertex (by factoring, partial factoring, or completing the square) gives you the optimal value (i.e., the maximum or minimum)

Remember that in word problems it is always important to identify the variables and sketching the parabola can be useful.

Apr 25-2:44 PM

## Solving Problems Using Quadratic Relations

Ex.1 A hose is placed on an aerial ladder. The hose sprays water on a forest fire. The height of the water, *h*, in metres can be modelled by the relation

$$h = -2.25(d - 1)^2 + 9,$$

where *d* is the horizontal distance, in metres, of the water from the nozzle of the hose.

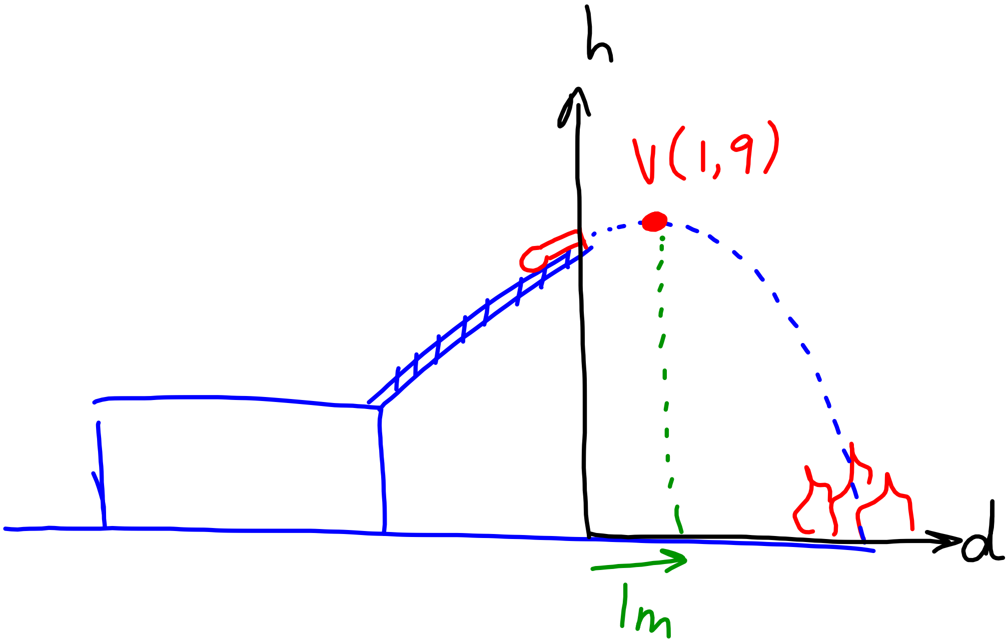
a) What is the maximum height reached by the water?

$V(\underset{d}{\overset{x}{1}}, \underset{h}{\overset{y}{9}})$ $\therefore$ the max. height is 9m.

b) At what horizontal distance from the nozzle is the maximum height reached?

$\therefore$ max height occurs 1 m (horizontally) from ladder.

Apr 25-2:56 PM




Apr 28-2:23 PM

Ex.1 A hose is placed on an aerial ladder. The hose sprays water on a forest fire. The height of the water, *h*, in metres can be modelled by the relation

$$h = -2.25(d - 1)^2 + 9,$$

where *d* is the horizontal distance, in metres, of the water from the nozzle of the hose.

c) What is the height of the aerial ladder?

y-int
$d = 0$

set $d = 0$: $h = -2.25(0-1)^2 + 9$
$= -2.25(1) + 9$
$= 6.75$

$\therefore$ the ladder is 6.75m high.

d) How high is the water when it is at a horizontal distance of 2m from the nozzle?

set $d = 2$: $h = -2.25(2-1)^2 + 9$
$= -2.25(1) + 9$
$= 6.75$

Apr 25-2:56 PM

Ex.2 A ball is thrown into the air. Its height, in metres, after *t* seconds, is $h = -4.9t^2 + 39.2t + 1.75$.

a) When does it reach maximum height? → vertex form?

$t$

$h = -4.9t^2 + 39.2t + 1.75$

$h = -4.9[t^2 - 8t] + 1.75$

$\frac{-8}{2} = -4$

$(-4)^2 = 16$

$h = -4.9[t^2 - 8t + 16 - 16] + 1.75$

$h = -4.9[(t-4)^2 - 16] + 1.75$

$h = -4.9(t-4)^2 + 78.4 + 1.75$

$h = -4.9(t-4)^2 + 80.15$

$V(\overset{x}{\underset{t}{4}}, \overset{y}{\underset{h}{80.15}})$ ∴ max. height after 4 seconds.

b) What is the maximum height?

∴ max. height is 80.15m.

Apr 22-9:25 PM

Ex.2 A ball is thrown into the air. Its height, in metres, after *t* seconds, is $h = -4.9t^2 + 39.2t + 1.75$.

c) From what height is the ball released?

initial height

$t = 0$

~~y~~ h-int

∴ the ball is released from 1.75m.

d) When does the ball hit the ground?

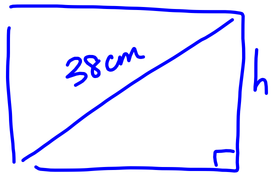
$t = ?$ $h = 0$

$0 = -4.9t^2 + 39.2t + 1.75$

solve using quadratic formula

Apr 25-3:03 PM

Ex.3 The size of a television screen or computer monitor is usually stated as the length of the diagonal. A screen has a 38-cm diagonal. The width of the screen is 6 cm more than the height. Find the dimensions of the screen to the nearest tenth.




$w = h + 6$

$$h^2 + w^2 = 38^2$$
$$h^2 + (h+6)^2 = 1444$$
$$h^2 + h^2 + 12h + 36 = 1444$$
$$\frac{2h^2}{2} + \frac{12h}{2} - \frac{1408}{2} = \frac{0}{2}$$
$$h^2 + 6h - 704 = 0$$

$(h+6)^2$
$= (h+6)(h+6)$
$= h^2 + 6h + 6h + 36$
$= h^2 + 12h + 36$

S 6
P −704
I ~~X~~

→ use quadratic formula

Nov 29-9:17 PM

Assigned Work:

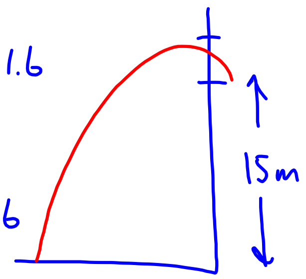
p. 357 #2, 3, 5, 7, 9, 14
b

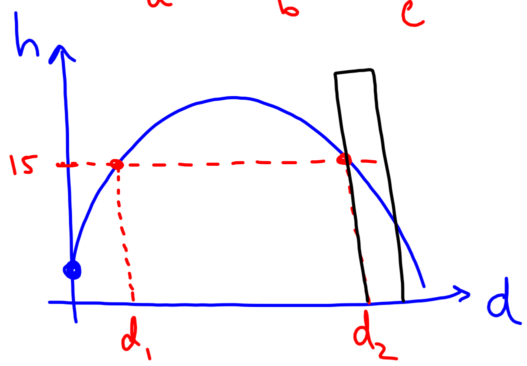
3(b) $H = -0.011x^2 + 0.99x + 1.6$

Set $H = 15$

$15 = -0.011x^2 + 0.99x + 1.6$

$0 = -0.011x^2 + 0.99x - 13.4$
a b c




Apr 25-2:54 PM

5. $V(\overset{x}{\underset{x}{28}}, \overset{y}{\underset{P}{1024}})$ $P(10, -4160)$

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

$P = \underset{?}{\underline{\underline{a}}}(x-28)^2 + 1024$

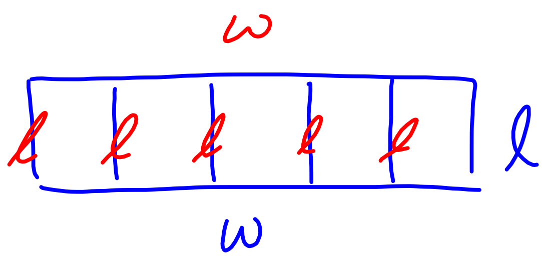
sub $(10, -4160)$, solve for 'a'.

(b) break even, $P = 0$

set $P = 0$, solve for $x$.

Apr 29-12:44 PM

7.




$A = lw$

$\frac{6l}{2} + \frac{2w}{2} = \frac{30}{2}$

$3l + w = 15$

$w = 15 - 3l$

$A = l(15-3l)$

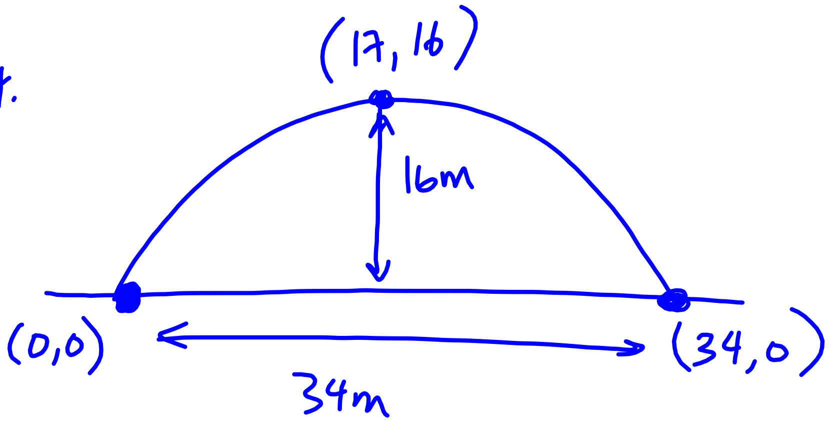
zeroes: set $A = 0$

MP of zeroes, $x_v$

sub MP to find $y_v$

Apr 29-12:48 PM

14.




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

$$y = a(x-17)^2 + 16$$

Sub (0,0) or (34,0)

$$y = a(x-s)(x-t)$$

$$= a(x-0)(x-34)$$

$$= ax(x-34)$$

Sub (17,16)

Apr 29-12:51 PM