## Warm - up

Find the zeros by factoring. ~~Check by graphing the intercept form and the standard form of each relation~~.

**a)** $y = x^2 + 10x + 16$ **b)** $y = x^2 - 2x - 35$

Given each quadratic relation in vertex form, express the relation in standard form and in intercept form. ~~Then, check your answers by graphing all three forms~~.

Factored form

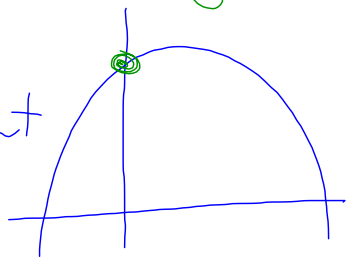
**a)** $y = (x + 5)^2 - 4$ **b)** $y = (x - 3)^2 - 36$

# PROBLEM SOLVING

## USING ZEROS AND OTHER PARTS OF THE PARABOLA

1. A ball is thrown upwards. Its height is described by the equation $h=-2t^2 + 10t + 12$, where h is in meters and t is in seconds.

a. How high is the ball when it was thrown?
What part of the parabola do you need? y-int




$t = 0$

$h = -2(0)^2 + 10(0) + 12$

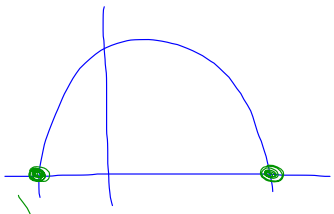
$= -2(0) + 10(0) + 12$

$= 0 + 0 + 12$

$= 12$

$\therefore$ initial height is 12m

b. When does the ball hit the ground?
What part of the parabola do we need? zeros



$0 = -2t^2 + 10t + 12$

$0 = -2(t^2 - 5t - 6)$

$0 = -2(t - 6)(t + 1)$

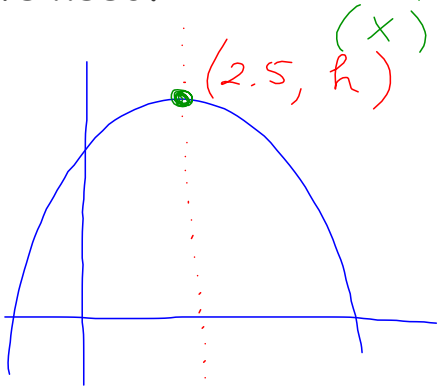
$t - 6 = 0$
$t = 6$

$t + 1 = 0$
$t = -1$

inadmissable
can't go back in time

$\therefore$ the ball hits the ground at 6 sec.

c. When is the ball at its highest?
What part of the parabola do we need? vertex (x)




Axis of symmetry

$$\frac{6+(-1)}{2}$$

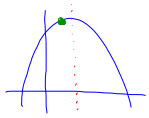
$$=\frac{5}{2}$$

$$=2.5$$

∴ the ball is at its highest at 2.5 sec.

d. How high is the ball at 2 seconds? $t=2$ $h=?$

$$h=-2(2)^2+10(2)+12$$
$$=-2(4)+10(2)+12$$
$$=-8+20+12$$
$$=24$$



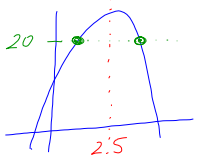
∴ 24 m

e. When is the ball at 20 meter high?

$h=20$

$$20=-2t^2+10t+12$$

$-20$ to make left side zero




$$0=-2t^2+10t+12-20$$
$$0=-2t^2+10t-8$$
$$0=-2(t^2-5t+4)$$
$$0=-2(t-1)(t-4)$$

$t-1=0$, $t=1$ $\qquad$ $t-4=0$, $t=4$

∴ the ball is at a height of 20 m at 1 sec. and 4 sec.

2. On planet X, the height , h meters, of an object fired upward from the ground at 48 m/s is described by the equation $h = -16t^2 + 48t$, where t seconds is the time since the object was fired.

a. What is the maximum height?
What part of the parabola do you need? vertex

1. Find zeros
2. AOS
3. Vertex

1. $h = 0$
$0 = -16t^2 + 48t$
$0 = -16(t)(t - 3)$
$t = 0$ $\quad t - 3 = 0$, $t = 3$

2. AOS
$t = \frac{0+3}{2}$
$t = 1.5$

3. AOS $t = 1.5$
vertex $(1.5, h)$
$h = -16(1.5)^2 + 48(1.5)$
$= 36$

∴ highest height is 36 meters

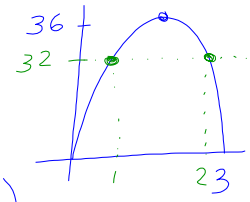
b. When does the object hit the ground?
What part of the parabola do you need? zeros

from a., zeros are 0 and 3

object hits ground at 3 sec.

$t = 0 \Rightarrow$ launch of the object

c. When is the object 32 m above the ground?




$32 = -16t^2 + 48t$
$0 = -16t^2 + 48t - 32$
$0 = -16(t^2 - 3t + 2)$
$0 = -16(t - 2)(t - 1)$
$t - 2 = 0$, $t = 2$ $\quad t - 1 = 0$, $t = 1$

∴ the object is at 32 m at 1 and 2 sec.

## On the Boards...

A baseball is thrown from the top of a building and falls to the ground below. Its path is approximated by the relation $h = -5t^2 + 5t + 30$, where $h$ is the height above ground in metres and $t$ is the elapsed time in seconds.

(a) How tall is the building? $t = 0 \quad \therefore h = 30$

(b) When will the ball hit the ground?

(c) When does the ball reach its maximum height?

(d) How high above the building is the ball at its maximum height?

b) $h = -5t^2 + 5t + 30$

$= -5(t^2 - t - 6)$

$= -5(t - 3)(t + 2)$

$t = 3 \qquad t = -2$

$\therefore$ at 3 sec.

c) AOS $\frac{3 + (-2)}{2} = 0.5$

d.) vertex $(0.5, h)$

$h = -5(0.5)^2 + 5(0.5) + 30$

$h = 31.25$

$\therefore$ max height is 31.25 m

# Homework / Seatwork

# pg 282 # 2, 5ace, 7-12