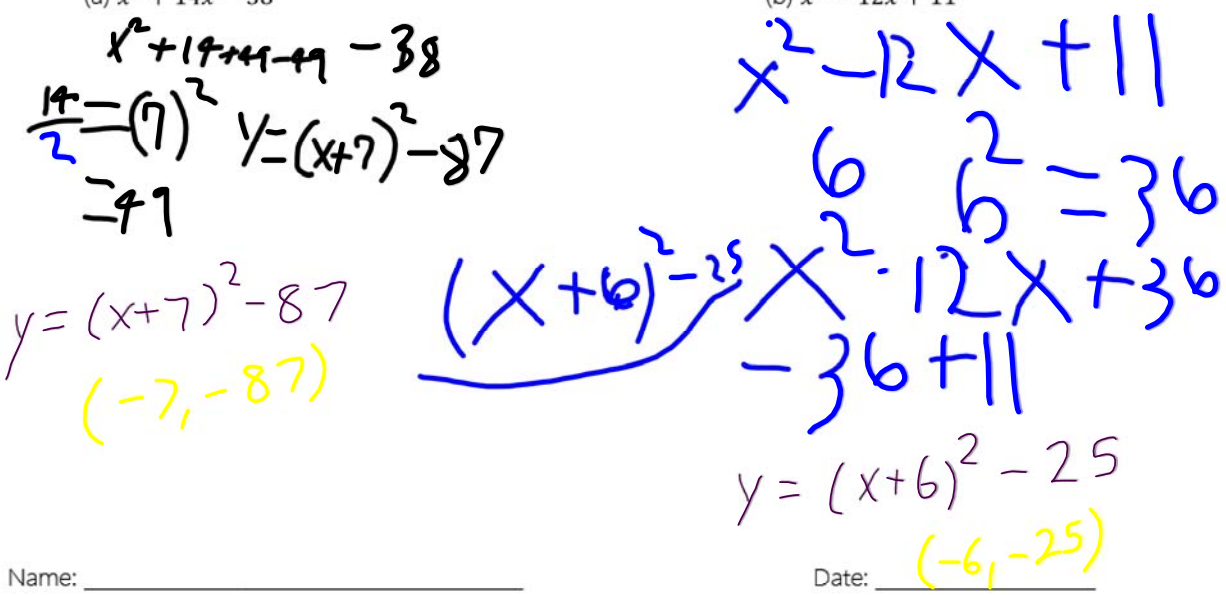
Name: _____ Date: _____

Do Now

Write each of the following in **vertex form** and identify the **turning point**. You will need to COMPLETE THE SQUARE!

(a) $x^2 + 14x - 38$

(b) $x^2 - 12x + 11$



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THE ZEROES OF A QUADRATIC

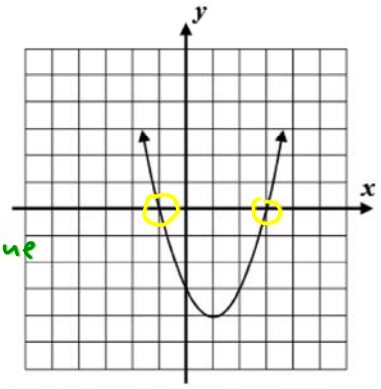
The x-locations on any function where the output (the y-coordinate) is equal to zero are known, not surprisingly, as the **zeroes of the function**. These are amazingly important in applied settings. When they are **rational numbers** then they can be found using a factoring technique. We'll develop the idea in the first exercise.

***Exercise* #1:** Consider the quadratic function $y = x^2 - 2x - 3$. It's graph is shown below.

x-intercepts

(a) What are the zeroes of the function? Write their x-values and circle them on the graph.

$x = -1$ $x = 3$



(b) Factor the expression $x^2 - 2x - 3$. How do these factors compare to the zeroes?

-1 and 3 ✗
-3 and 1 ✓

A M
$x^2 - 2x - 3$
y-value
$(x-3)(x+1) = 0$

(c) Based on (b), determine where the zeroes of $y = x^2 + 3x - 10$ are algebraically. Verify using a table.

$x - 3 = 0$ | $x + 1 = 0$
$+3 \quad +3$ | $-1 \quad -1$
$x = 3$ | $x = -1$

What is really going on here is perhaps the **second most important equation solving technique**, known as the **Zero Product Law**.

THE ZERO PRODUCT LAW

If two or more quantities have a product of **zero** then at least one of them must be equal to **zero**. In symbolic form:

If $a \cdot b = 0$ then either $a = 0$ or $b = 0$ (or both are zero)

***Exercise* #2:** Use the Zero Product Law to find all solutions to each of the following equations.

(a) $(x+7)(x-2) = 0$

$x + 7 = 0$ | $x - 2 = 0$
$-7 \quad -7$ | $+2 \quad +2$
$x = -7$ | $x = 2$

(b) $(2x-1)(3x+4) = 0$

$2x - 1 = 0$ | $3x + 4 = 0$
$+1 \quad +1$ | $-4 \quad -4$
$\frac{2x}{2} = \frac{1}{2}$ | $\frac{3x}{3} = \frac{-4}{3}$
$x = \frac{1}{2}$ | $x = -\frac{4}{3}$

The **Zero Product Law** is remarkable because it allows us to solve equations with an x^2 or higher level term in it, as long as the expression set equal to zero can be **factored**.

***Exercise* #3:** Find the **roots** (solutions) to each of the following equations by using the **Zero Product Law**. Sometimes you will be instructed to **solve by factoring**.

(a) $x^2+4x-12=0$

A M

$(x-2)(x+6)=0$

$x-2=0$ $x+6=0$

$x=2$ $x=-6$

(b) $2x^2-14x=0$

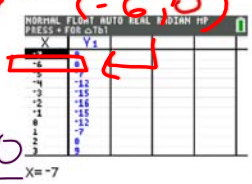
$2x(x-7)=0$

$\frac{2x}{2}=\frac{0}{2}$ $x-7=0$

$x=0$ $+7\ +7$

$x=7$

(c) $x^2-25=0$



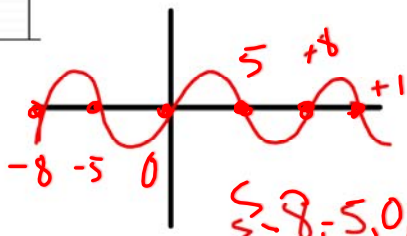
$(x-5)(x+5)=0$

$x-5=0$ $x+5=0$

$x=5$ $x=-5$

$\{5,-5\}$

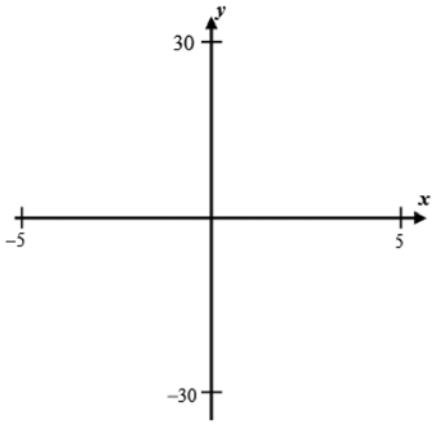
(d) $2x^2+5x-12=0$



a Set Can contain any amount of digits, or none

$\{-8,-5,0,5,8\}$ $\{\ \}$

***Exercise* #4:** Find the zeroes of the quadratic function $y=3x^2-6x-24$ algebraically. Then verify your answer by using your calculator to sketch a graph of the parabola using the window indicated on the axes below. Clearly mark the zeroes on the graph.



Name: _____ Date: _____

THE ZEROES OF A QUADRATIC
HOMEWORK

1. The roots of $x^2 - 6x - 16 = 0$ can be found by factoring as

   (1) $\{-16, 6\}$ (3) $\{-2, 8\}$

   $x = -16$ $x = 6$ $x = -2$ $x = 8$

   (2) $\{-8, 2\}$ (4) $\{6, 16\}$

2. The equation $(2x-3)(x+7) = 0$ has a solution set of

   (1) $\{-7, 1\frac{1}{2}\}$ (3) $\{-7, 3\}$

   (2) $\{3, 7\}$ (4) $\{\frac{1}{2}, -3\}$

3. Find the roots of each of the following equations by factoring:

   (a) $x^2 - 36 = 0$ (b) $x^2 + 12x + 27 = 0$

   (c) $3x^2 + 5x - 2 = 0$ (d) $20x^2 - 10x = 0$

   (e) $10x^2 + x - 21 = 0$ (f) $4x^2 - 16x - 84 = 0$