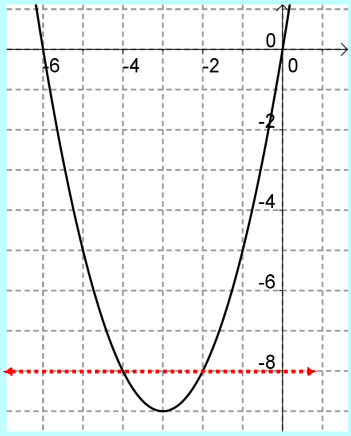
<u>Intersection of Quadratics & Lines</u>

(more solving quadratic equations)

Recall from last class:

Consider $y = x^2 + 6x$, and solve for $y = -8$.



In this example, we were actually <u>solving</u> for the <u>intersection</u> between the parabola and the horizontal straight line.

Solutions: (-4, -8) and (-2, -8)

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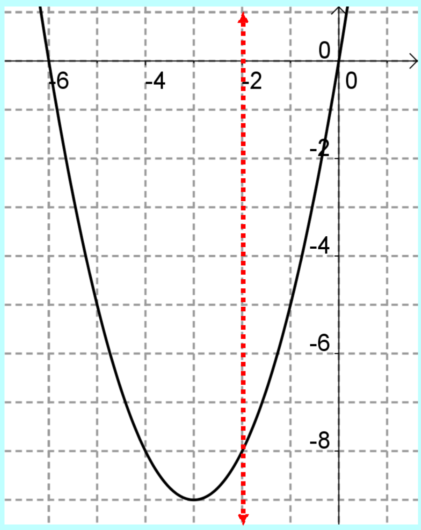
<u>Intersection of Quadratics & Lines</u>

(more solving quadratic equations)

Recall from last class:

Consider $y = x^2 + 6x$, and solve for $x = -2$.



In this example, we solve for the intersection between the parabola and the vertical straight line.

Solution: (-2, -8)

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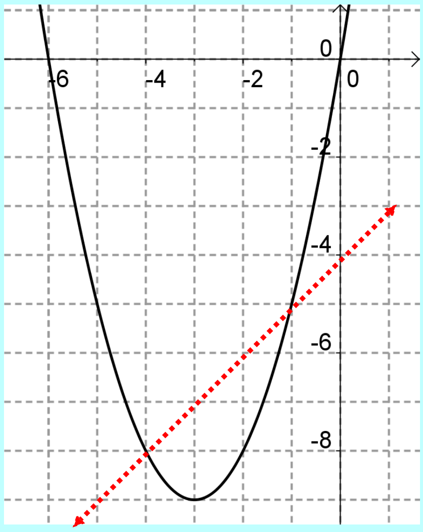
Intersection of Quadratics & Lines

(more solving quadratic equations)

Recall from last class:

Consider $y = x^2 + 6x$, and solve for $y = x - 4$.



In this example, we solve for the intersection between the parabola and the given straight line.

Solutions: (-4, -8) and (-1, -5)

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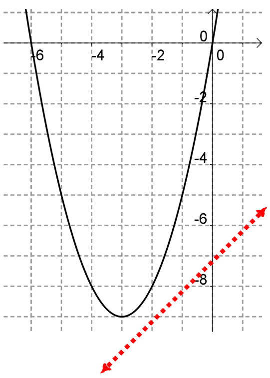
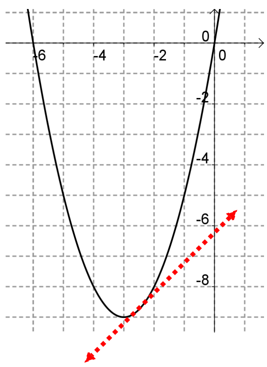
Intersection of Quadratics & Lines

(more solving quadratic equations)

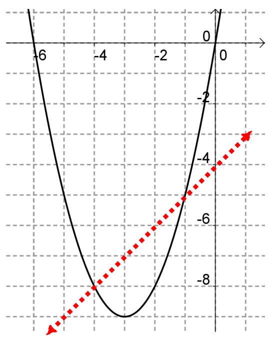
A linear-quadratic system will have zero, one, or two solutions.



No Solution



One Solution (tangent line)



Two Solutions (secant line)

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Recall: To solve an equation is to find the value(s) for the variables that satisfy the equation (i.e., make it true)

Given a quadratic relation, $y = Ax^2 + Bx + C$

and a linear relation, $y = mx + b_1$

the solution will be the point(s) where the parabola and straight line intersect.

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$y = Ax^2 + Bx + C$ (1) $y = mx + b_1$ (2)

Solve the system of equations using the fact that $y = y$

$$y = y$$
$$Ax^2 + Bx + C = mx + b_1$$
$$\vdots$$
$$ax^2 + bx + c = 0 \rightarrow \text{solve for } x \text{ (zeroes)}$$

Sub the x-values from the solution(s) into either original relation to find the corresponding y-values.

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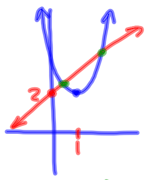
Ex.1 Find the points of intersection (if any) between $y=2(x-1)^2+2$ and $y=x+2$.

$V(1,2)$



$y=y$

$2(x-1)^2+2=x+2$

$2(x^2-2x+1)+2=x+2$

$2x^2-4x+2+2=x+2$

$2x^2-5x+2=0$

$2x^2-4x-x+2=0$

$2x(x-2)-1(x-2)=0$

$(x-2)(2x-1)=0$

$(x-1)^2$
$=(x-1)(x-1)$
$=x^2-x-x+1$
$=x^2-2x+1$

S -5
P 4
$-4,-1$

$x-2=0$ or $2x-1=0$

$\boxed{x=2}$ $\quad 2x=1$

$\boxed{x=\frac{1}{2}}$

Sub $x=2$
$y=2+2$
$=4$

Sub $x=\frac{1}{2}$
$y=\frac{1}{2}+2$
$y=\frac{5}{2}$

$\therefore$ solutions are (points of intersection) $(2,4)$ and $\left(\frac{1}{2},\frac{5}{2}\right)$

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Ex.2 Determine the equations of the lines that have a slope of 2 that intersect $y=x(6-x)$

(a) once

(b) twice

(c) never

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Assigned Work:

worksheet

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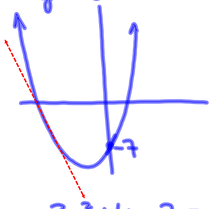
4. $m=-6$ $\quad y=3x^2+6x-7$

$y=-6x+b$

slope at the y-int



want 1 sol'n

$3x^2+6x-7=-6x+b$

$3x^2+12x-7-b=0$

$ax^2+bx+c=0$

$D=b^2-4ac$

>0, 2 sol $\quad =0$, 1 sol $\quad <0$, no sol.

$b^2-4ac=0$

$(12)^2-4(3)(-7-b)=0$

$144-12(-7-b)=0$

$144+84+12b=0$

$12b=-228$

$b=-19$

$\therefore$ for one solution,

$y=-6x-19$

for 2 solutions, y-int >-19

for 0 solutions, y-int <-19

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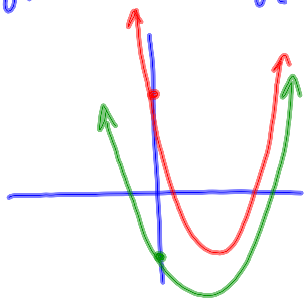
6. $y_1 = x^2 - 4x - 5$ $\quad y_2 = 3x^2 - 6x + 7$



$y_1 = y_2$

$x^2 - 4x - 5 = 3x^2 - 6x + 7$

$\frac{0}{2} = \frac{2x^2}{2} - \frac{2x}{2} + \frac{12}{2}$

$0 = x^2 - x + 6$

S -1
P 6
I $\times$

$D = b^2 - 4ac$

$= (-1)^2 - 4(1)(6)$

$= 1 - 24$

$= -23$

< 0 $\therefore$ no solutions

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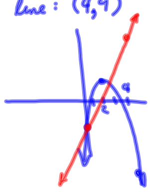
5. same y-int $= -3$ $(0,-3)$
parabola: $(2,1)$ and $(4,-11)$
line: $(4,9)$



$y = mx + b$

$y = mx - 3$

sub $(4,9)$

$9 = m(4) - 3$

$12 = 4m$

$m = 3$

$\boxed{y = 3x - 3}$

$y = ax^2 + bx + c$

$y = ax^2 + bx - 3$

Sub $(2,1)$

$1 = a(2)^2 + b(2) - 3$

$1 = 4a + 2b - 3$

$4 = 4a + 2b$

$2 = 2a + b$ ①

Sub $(4,-11)$

$-11 = a(4)^2 + b(4) - 3$

$-8 = 16a + 4b$

$-2 = 4a + b$ ②

$2 = 2a + b$ ①

$-2 = 4a + b$ ②

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

$\boxed{a = -2}$

sub $a = -2$ into ①

$2 = 2(-2) + b$

$2 = -4 + b$

$\boxed{b = 6}$ $\quad \boxed{\therefore y = -2x^2 + 6x - 3}$

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