Graphing quadratics in standard form:

Standard Form: $y = ax^2 + bx + c$

Rewrite in vertex form by **completing the square.**

Example 3: Rewrite each quadratic in vertex form then graph.

a) $y = x^2 + 6x + 5$

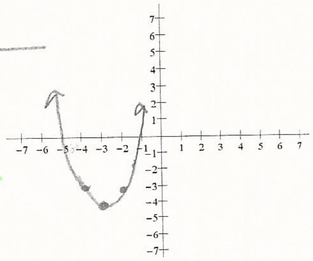
$y = (x^2 + 6x + \_\_\_) + 5 - \_\_\_$

$\left(\frac{6}{2}\right) = 3 \quad (3)^2 = 9$

$y = (x^2 + 6x + 9) + 5 - 9$

$y = (x + 3)^2 - 4$

vertex: $(-3, -4)$



b) $y = x^2 + 8x + 10$

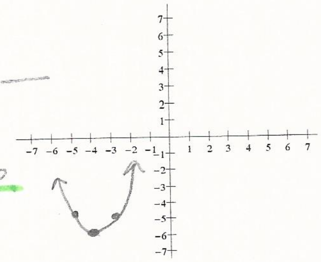
$y = (x^2 + 8x + \_\_\_) + 10 - \_\_\_$

$\frac{8}{2} = 4 \quad (4)^2 = 16$

$y = (x^2 + 8x + 16) + 10 - 16$

$y = (x + 4)^2 - 6$

vertex: $(-4, -6)$



c) $y = 3x^2 - 12x + 24$

$y = (3x^2 - 12x + \_\_\_) + 24 - \_\_\_$

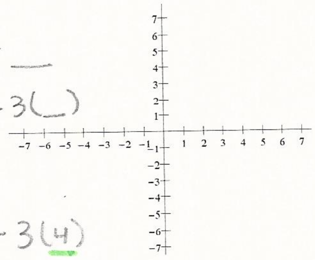
$y = 3(x^2 - 4x + \_\_\_) + 24 - 3(\_\_\_)$

$\frac{-4}{2} = -2 \quad (2)^2 = 4$

$y = 3(x^2 - 4x + 4) + 24 - 3(4)$

$y = 3(x - 2)^2 + 12$

vertex: $(2, 12)$



d) $y = -2x^2 + 12x - 13$

$y = (-2x^2 + 12x + \_\_\_) - 13 - \_\_\_$

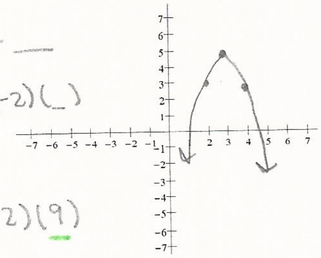
$y = -2(x^2 - 6x + \_\_\_) - 13 - (-2)(\_\_\_)$

$\frac{-6}{2} = -3 \quad (-3)^2 = 9$

$y = -2(x^2 - 6x + 9) - 13 - (-2)(9)$

$y = -2(x - 3)^2 + 5$

vertex: $(3, 5)$



Writing Equations of Lines

Point-Slope Form: $y = m(x - x_1) + y_1$

m = slope

x_1 and y_1 are from the point that is given to you. (x_1, y_1)

Example 4: Use the given information to write the equation of each line.

a) point (4, -3), slope = 2

$y = 2(x - 4) + (-3)$

$y = 2x - 8 - 3$

$\boxed{y = 2x - 11}$

b) point (-3, -2), slope = $\frac{1}{2}$

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

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

$y = \frac{1}{2}x + \frac{3}{2} - 2$

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

c) point (0, 3) and (-2, 7)

$m = \frac{7-3}{-2-0} = \frac{4}{-2} = -2$

*use point (0,3)

$y = -2(x - 0) + 3$

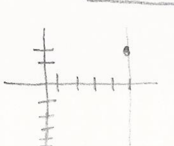
$\boxed{y = -2x + 3}$

d) point (5, -8) and (5, 2)

$m = \frac{-8-2}{5-5} = \frac{-10}{0}$

slope is undefined.

$\boxed{x = 5}$



e) point (3, -1), parallel to the line y = 4x + 7

$m = 4$

$m = 4$

$y = 4(x - 3) + (-1)$

$y = 4x - 12 - 1$

$\boxed{y = 4x - 13}$

f) point (0, 5) perpendicular to the line y = 4x + 7

$m = 4$

$m = -\frac{1}{4}$

$y = -\frac{1}{4}(x - 0) + 5$

$\boxed{y = -\frac{1}{4}x + 5}$

Factoring

Example 1: Factor out a common monomial

a) $5x^4+10x^3+25x$

GCF: $5x$

$\boxed{5x(x^3+2x^2+5)}$

b) $6x^4+21x^2$

GCF: $3x^2$

$\boxed{3x^2(2x^2+7)}$

c) $-2x^3+8x^2-18x$

GCF: $-2x$

$\boxed{-2x(x^2-4x+9)}$

Example 2: Factor using guess and check. Recall: ax^2+bx+c

a) $x^2+9x+18$

18 9

6,3 | 9

$x^2+6x+3x+18$

$x(x+6)+3(x+6)$

$\boxed{(x+6)(x+3)}$

b) x^2-x-6

−6 −1

−3, 2 | −1

$x^2-3x+2x-6$

$x(x-3)+2(x-3)$

$\boxed{(x-3)(x+2)}$

c) $2x^2-5x-3$ $a \cdot c = 2(-3) = -6$

−6 −5

−6, 1 | −5

$2x^2-6x+x-3$

$2x(x-3)+1(x-3)$

$=\boxed{(x-3)(2x+1)}$

d) $6x^2-13x+2$ $a \cdot c = 6(2) = 12$

12 −13

−12, −1 | −13

$6x^2-12x-x+2$

$6x(x-2)+1(x-2)$

$=\boxed{(x-2)(6x+1)}$

e) $2x^2+7x-4$ $a \cdot c = 2(-4) = -8$

−8 7

8, −1 | 7

$2x^2+8x-x-4$

$2x(x+4)-1(x+4)$

$=\boxed{(x+4)(2x-1)}$

f) $10x^2+7x-12$ $a \cdot c = 10(-12) = -120$

−120 7

15, −8 | 7

$10x^2+15x-8x-12$

$5x(2x+3)-4(2x+3)$

$=\boxed{(2x+3)(5x-4)}$

Example 3: Factor by grouping.

a) $x^3+4x^2+5x+20$

$x^2(x+4)+5(x+4)$

$=\boxed{(x+4)(x^2+5)}$

b) $8x^3+2x^2-12x-3$

$2x^2(4x+1)-3(4x+1)$

$=\boxed{(4x+1)(2x^2-3)}$

c) $2x^3+3x^2-8x-12$

$x^2(2x+3)-4(2x+3)$

$=(2x+3)(x^2-4)$ ← difference of squares $a^2-b^2=(a-b)(a+b)$

$=\boxed{(2x+3)(x-2)(x+2)}$

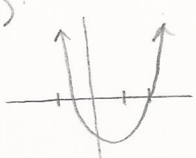
Solve Equations Graphically:

1. When equal to zero:	2. When variables are on both sides:
$ax^2+bx+c=0$ • use the graph to find the x-intercepts (or zeros)	$ax^2+b=dx^3+c$ • graph $y_1=ax^2+b$ and $y_2=dx^3+c$ and find where the lines intersect.

Example 1: Solve each equation graphically.

a) $2x^2-3x-2=0$

• use the calculator to graph $y=2x^2-3x-2$ and find the x-intercepts (zeros)



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

b) $6c+4=c^3+5c-1$

• use $y_1=6x+4$ and $y_2=x^3+5x-1$. Find where the graphs intersect.

$\boxed{x \approx 1.9042}$

c) $|2x-1|=6$

• use $y_1=|2x-1|$ and $y_2=6$. Find where the graphs intersect.

$\boxed{x=-\frac{5}{2} \quad x=\frac{7}{2}}$