**Sections 2.1 & 2.2 - I.C.E.** Name: KEY

**SHOW ALL WORK!!!! ☺**

Assume you cannot use a graphing calculator for these problems.
**The ones on which you CAN use a graphing calculator are starred.**

1. $f(x)=-(x^2+x-30)$ (for vertex, use $h=\frac{-b}{2a}$ and $k=f(h)$)

   a) Vertex:

   $\frac{+1}{2(-1)}=\frac{-1}{2}$ $\quad f(-\frac{1}{2})=-\left((-\frac{1}{2})^2+(-\frac{1}{2})-30\right)=-\left(\frac{1}{4}-\frac{2}{4}-\frac{120}{4}\right)=-\left(-\frac{121}{4}\right)$

   $=\frac{121}{4}=30.25$

   $(-\frac{1}{2}, \frac{121}{4})$

   b) x-intercepts:

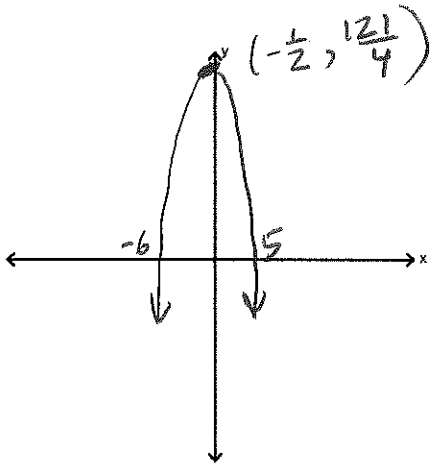
   $0=-(x^2+x-30)$

   $0=-(x+6)(x-5)$

   $x=-6, x=5$

   $(-6,0), (5,0)$

   c)




2. $f(x)=x^2+12x+16$ (find the vertex by completing the square)

   b) Vertex:

   $f(x)=(x^2+12x+36)+16-36$

   $=(x+6)^2-20$

   Vertex: $(-6,-20)$

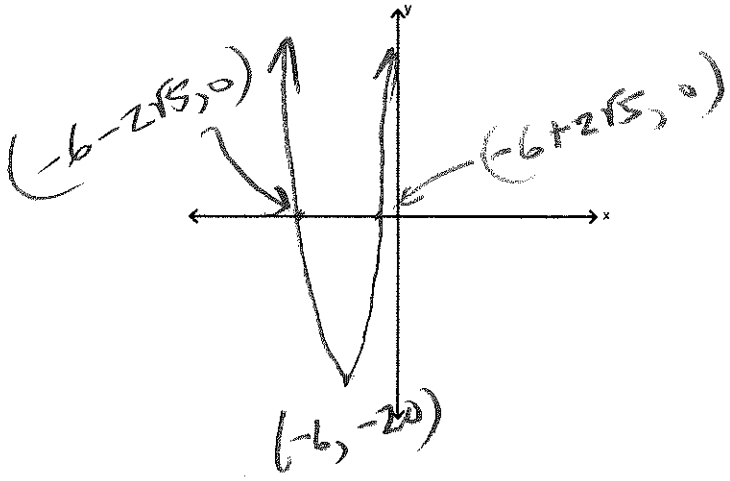
   b) x-intercepts:

   $\frac{-12\pm\sqrt{144-4(1)(16)}}{2}$

   $=-6\pm\frac{4\sqrt{5}}{2}$

   $=-6\pm2\sqrt{5}$

   c)



For questions 3 and 4, give the equations, in vertex form, for the following graphs.

3. Vertex: $\left(\frac{5}{2}, -\frac{3}{4}\right)$, passing through (-2, 4)

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

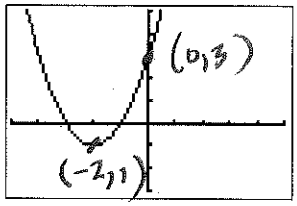
$4 = a(-2 - \frac{5}{2})^2 - \frac{3}{4}$

$4 = a(-9/2)^2 - 3/4$

$19/4 = a(81/4)$

$a = 19/81 \rightarrow$ $y = \frac{19}{81}(x - \frac{5}{2})^2 - \frac{3}{4}$

4. Use the points that are most clear on this graph:




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

$3 = a(0+2)^2 - 1$

$a = 4/4 = 1$

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

5. Find a quadratic function whose graph has the given x – intercepts. (Many answers)

x-intercepts: (-2, 0) and (4, 0)

$y = (x+2)(x-4)$ ← factored form

$y = x^2 - 2x - 8$ ← standard form

*6. The path of a diver is $y = -\frac{4}{9}x^2 + \frac{24}{9}x + 12$ where y is the height (in feet) and x is the horizontal distance from the end of the diving board (in feet). What is the maximum height of the diver? (Do the work algebraically, then confirm graphically)

$x = \frac{-b}{2a} = \frac{-24/9}{2(-4/9)} = 3$ ← horizontal distance

$y = -\frac{4}{9}(3)^2 + \frac{24}{9}(3) + 12$

$= \boxed{16 \text{ ft}}$ ← maximum height

For questions 7 and 8, determine the left hand and right hand behavior of the graph of function. Fill in the blank with the appropriate sign (positive or negative)

7. $y=3x^4-2x^3+x$

as $x\to\infty$, $y\to$ $+$ $\infty$

as $x\to-\infty$, $y\to$ $+$ $\infty$

8. $y=5x^5-6x+3$

as $x\to\infty$, $y\to$ $+$ $\infty$

as $x\to-\infty$, $y\to$ $-$ $\infty$

9. $f(x)=x^3-6x^2+9x$

a) find the zeros and determine the multiplicity of each zero

$x(x^2-6x+9)$

$x(x-3)(x-3)$

$x(x-3)^2$

$x=0$ (multiplicity 1 – cross)

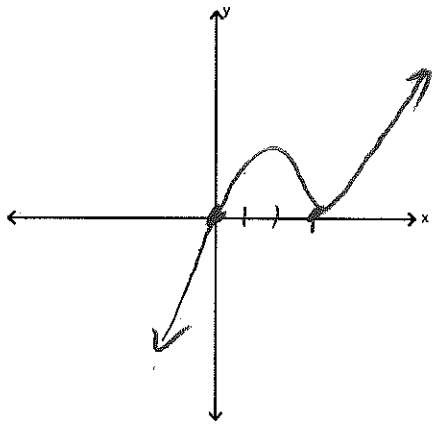
$x=3$ (mult 2 → bounce)

b) determine the left/right hand behavior for each

as $x\to\infty$, $y\to\infty$

as $x\to-\infty$, $y\to-\infty$

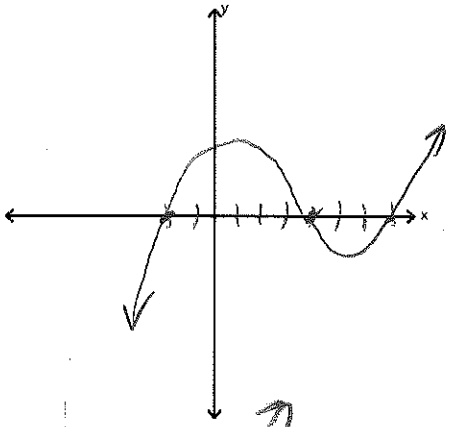
c) use this information to sketch a graph.



10. Find a polynomial of degree n that has the given zeros and then draw a sketch of your polynomial. You do not need to FOIL it out. (Many correct answers)

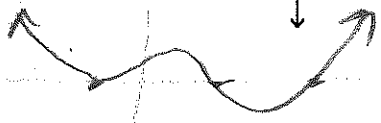
Zeros: x = -2, 4, 7 Degree: n = 3

$y=(x+2)(x-4)(x-7)$




what if I said degree 4?

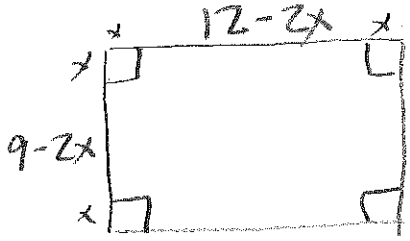
$y=(x+2)^2(x-4)(x-7)$



*11. An open box with locking tabs is to be made from a square piece of material 12 inches on one side and 9 inches on the other, and this is to be done by cutting equal squares with side length x from the corners and folding up the sides.

a) What is the volume of the box in terms of x? (you can leave in factored form)

$V(x)=(12-2x)(9-2x)x$




b) What is the domain of the function V?

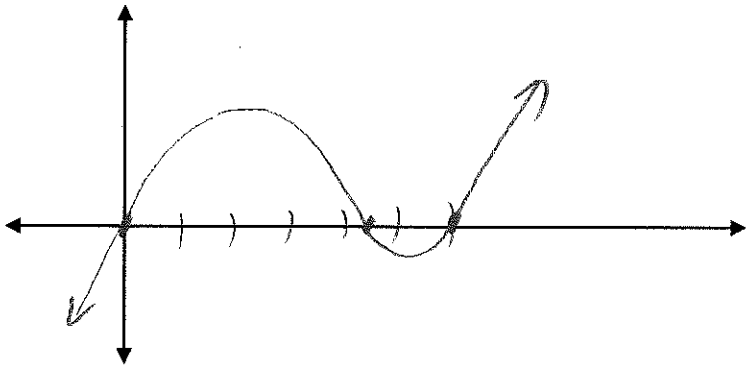
$x>0$ $12-2x>0$ $9-2x>0$

$x<6$ $x<9/2$

All three must be true, so

$0<x<9/2$

c) Sketch a graph of the function and find the value of x that will give the maximum volume: (be sure to adjust your window so you can see the WHOLE graph!)



a good window:
x min: −1
x max: 10
y min: −10
y max: 100

Max volume at x = 1.697 in

Maximum volume is 81.872 $in^3$

12. Maedan Error throws a softball; the table below shows the height ($h(t)$) of the ball t seconds after it is thrown. Give the quadratic regression equation that best fits the data. Round the coefficients to three decimals.

| t | 0.35 | 0.5 | 1 |
|---|---|---|---|
| $h(t)$ | 8 | 9.2 | 7.5 |

$h(t) = -17.538t^2 + 22.908t + 2.131$

13. Find a polynomial, $P(x)$, of degree 4 that has solutions at 1 (multiplicity 2), $\sqrt{7}$ (multiplicity 1) and $-\sqrt{7}$ (multiplicity 1) ~~if $P(0) = 21$~~. in standard form

$P(x) = (x-1)^2(x-\sqrt{7})(x+\sqrt{7})$

$= (x^2-2x+1)(x^2-7)$

$= x^4 - 7x^2 - 2x^3 + 14x + x^2 - 7$

$= x^4 - 2x^3 - 6x^2 + 14x - 7$