1) (2 points) What are the four ways to solve a quadratic equation?

1. Put your left side in
2. Put your left side out
3. Put your left side in
4. Now shake it all about.

2) (5 points each) Solve for the variable:

a) $x^2 - 25 = 0$

$x^2 = 25$

$\boxed{x = \pm 5}$

b) $4(x-2)^2 + 6 = 10$

$4(x-2)^2 = 4$

$(x-2)^2 = 1 \Rightarrow x-2 = \pm 1$

$x = 2 \pm 1 \Rightarrow \boxed{x = 3, 1}$

3) (3 points each) Fill the blank with the number necessary to complete the square and then factor. Show all necessary work:

a) $x^2 + 8x +$ ___16___

$\left(\frac{8}{2}\right)^2 = 16$

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

b) $x^2 - 17x +$ ___$\frac{289}{4}$___

$\left(-\frac{17}{2}\right)^2 = \frac{289}{4}$

$\boxed{\left(x - \frac{17}{2}\right)^2}$

4) (5 points each) Solve by completing the square:

a) $x^2 + 6x + 4 = 0$

$x^2 + 6x = -4$

$x^2 + 6x + 9 = -4 + 9$

$(x+3)^2 = 5 \Rightarrow x+3 = \pm\sqrt{5}$

$\boxed{x = -3 \pm \sqrt{5}}$

b) $3x^2 + 15x + 60 = 0$

$x^2 + 5x + 20 = 0$

$x^2 + 5x + \frac{25}{4} = -20 + \frac{25}{4}$

$\left(x + \frac{5}{2}\right)^2 = -\frac{55}{4} \Rightarrow x + \frac{5}{2} = \pm\sqrt{-\frac{55}{4}} = \pm \frac{\sqrt{55}}{2} i$

$\boxed{x = -\frac{5}{2} \pm \frac{\sqrt{55}}{2} i}$

5) (5 points each) Solve by using the quadratic formula:

a) $x^2 + 6x + 4 = 0$

$x = \frac{-6 \pm \sqrt{6^2 - 4(1)(4)}}{2(1)}$

$= \frac{-6 \pm \sqrt{20}}{2} = \frac{-6 \pm 2\sqrt{5}}{2}$

$= \boxed{-3 \pm \sqrt{5}}$

b) $3x^2 + 15x + 60 = 0$ divide by 3 to use smaller #s

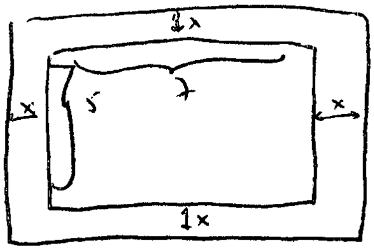
$x^2 + 5x + 20 = 0$

$x = \frac{-5 \pm \sqrt{5^2 - 4(1)(20)}}{2(1)} = \frac{-5 \pm \sqrt{-55}}{2}$

$= \boxed{-\frac{5}{2} \pm \frac{\sqrt{55}}{2} i}$

3P

6) (6 points) A 5x7 photo will have a matte that has a uniform width. If the entire area of the photo with the matte is to be 55.25 square inches, how wide should the matte be?



$A = lw = (2x+5)(2x+7) = 55.25$

$4x^2 + 24x + 35 = 55.25$

$4x^2 + 24x - 20.25 = 0$ $\quad x = \dfrac{-24 \pm \sqrt{24^2 - 4(4)(-20.25)}}{2(4)}$

$= \dfrac{-24 \pm \sqrt{900}}{8} = \dfrac{-24 \pm 30}{8} \Rightarrow \boxed{x = 3/4''}$ or $\cancel{x = \frac{27}{4}}$

7) (5 points each) Solve for the variable:

a) $x^4 - 9x^2 + 8 = 0$

Let $m = x^2$

$(x^2)^2 - 9(x^2) + 8 = 0$

$m^2 - 9m + 8 = 0 \Rightarrow (m-8)(m-1) = 0$

$m = 8 \qquad m = 1$

$x^2 = 8 \qquad x^2 = 1$ ⊃ take sq. root.

$\boxed{x = \pm 2\sqrt{2} \qquad x = \pm 1}$

b) $2x - 7\sqrt{x} + 3 = 0$

$2(\sqrt{x})^2 - 7(\sqrt{x}) + 3 = 0$ Let $p = \sqrt{x}$

$2p^2 - 7p + 3 = 0$

$(2p-1)(p-3) = 0$

$p = 1/2 \qquad p = 3$

$\sqrt{x} = 1/2$ $\boxed{x = \frac{1}{4}}$

$\sqrt{x} = 3$ $\boxed{x = 9}$

8) (3 points) Where is the vertex of the quadratic function $f(x) = \frac{3}{5}(x-4)^2 - 1$ located?

@ (4, -1)

9) (3 points) Explain the transformations necessary to sketch the graph of $f(x) = -2(x+3)^2 + 4$:

1) Left 3

2) Reflect over x-axis

3) V-stretch by a factor of 2

4) Up 4

10) (3 points each) For the function $f(x) = x^2 + 2x - 3$, find...

a) The vertex:

$x = -\frac{b}{2a} = \frac{-2}{2(1)} = -1$

$f(-1) = (-1)^2 + 2(-1) - 3 = -4$

(-1, -4)

b) The x-intercepts:

$x^2 + 2x - 3 = 0$

$(x+3)(x-1) = 0$

$x = -3, 1$

(-3, 0) (1, 0)

c) The y-intercept:

$f(0) = 0^2 + 2(0) - 3 = -3$

(0, -3)

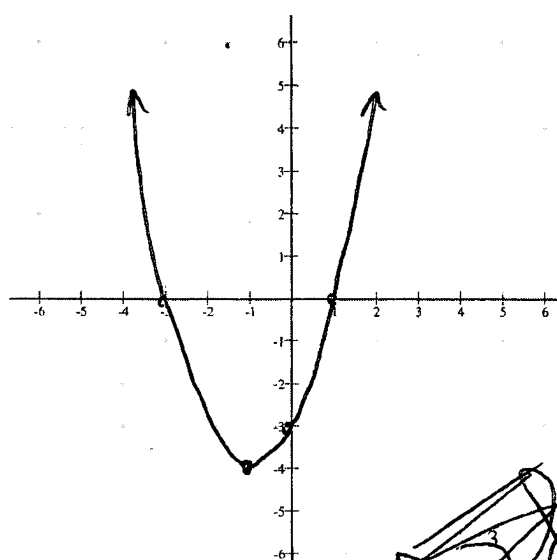
d) The domain:

$\mathbb{R}$

e) The range:

$[-4, \infty)$

f) The graph:



38

11) (3 points each) A large cupcake thrown into the air off of a 48-foot cliff follows a path given by the function $h(t) = -16t^2 + 32t + 48$ where h is the height in feet and t is time in seconds:

a) Find the time at which the cupcake will the highest off the ground:

$t = \frac{-32}{2(-16)} = 1$ sec

b) Find the highest height the cupcake will be in the air.

$h(1) = -16(1)^2 + 32(1) + 48$

$= 64$ ft

c) Find the time when the cupcake will hit the ground:

$-16t^2 + 32t + 48 = 0$

$t^2 - 2t - 3 = 0$

$(t-3)(t+1) = 0$

$\cancel{t=-1}$

$t = 3$

University research has shown that children actually hate small cupcakes.

12) (5 points each) Solve for the variable and write your answer in interval notation:

a) $10x^2 - 13x - 3 \geq 0$

$(2x-3)(5x+1) = 0$

$x = 3/2 \quad x = -1/5$

$+ \quad - \quad +$

$-1/5 \quad 3/2$

$(-\infty, -1/5] \cup [\frac{3}{2}, \infty)$

b) $\frac{x^2 + 6x + 5}{2x - 6} \geq 0$

$x^2 + 6x + 5 = 0 \Rightarrow x = -5, -1$

$2x - 6 = 0 \Rightarrow x = 3$

$- \quad + \quad - \quad +$

$-5 \quad -1 \quad 3$

$[-5, -1] \cup (3, \infty)$

13) (5 points) Graph the inequality $y \leq -x^2 + 4$: