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

1) Steal socks
2) Dance
3) ?
4) Profit

2) (4 points each) Solve for the variable:

a) $x^2-25=0$

$x^2=25$

$x=\pm 5$

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

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

$(x-2)^2=1$

$x-2=\pm 1$

$x=2\pm 1$ → $2+1=3$, $2-1=1$

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+_____

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

$(x+4)^2$

b) x^2-17x+_____

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

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

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

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

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

$(x+3)^2=5$

$x+3=\pm\sqrt{5}$

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

b) $4x^2-5x-6=0$

$4x^2-5x=6$

$x^2-\frac{5}{4}x+\frac{25}{64}=\frac{3}{2}+\frac{25}{64}$

$\left(x-\frac{5}{8}\right)^2=\frac{121}{64}$

$x-\frac{5}{8}=\pm\frac{11}{8}$

$x=\frac{5}{8}\pm\frac{11}{8}$ → $\frac{5}{8}+\frac{11}{8}=2$, $\frac{5}{8}-\frac{11}{8}=-\frac{3}{4}$

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

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

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

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

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

b) $4x^2-5x-6=0$

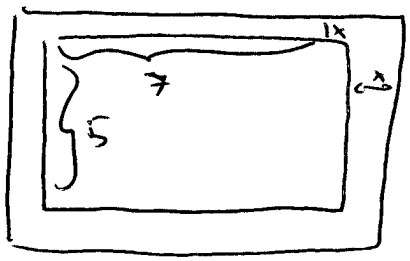
$x=\frac{-(-5)\pm\sqrt{(-5)^2-4(4)(-6)}}{2(4)}$

$=\frac{5\pm\sqrt{121}}{8}=\frac{5\pm 11}{8}$ → $\frac{5+11}{8}=2$, $\frac{5-11}{8}=-\frac{6}{8}=-\frac{3}{4}$

2

36

6) (5 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?



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

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

$4x^2+24x-20.25=0$

$x=\frac{-24\pm\sqrt{24^2-4(4)(-20.25)}}{2(4)}$

$=\frac{-24\pm\sqrt{900}}{8}=\frac{-24\pm30}{8}$

$\frac{3}{4}$ $-\frac{27}{4}$ ← throw

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

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

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

let $u=x^2$ $u^2-9u+8=0$

$(u-8)(u-1)=0$

$u=8$ $u=1$

$x^2=8$ $x^2=1$

$x=\pm2\sqrt{2}$

$x=\pm1$

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

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

let $m=\sqrt{x}$

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

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

$m=1/2$ $m=3$

$\sqrt{x}=\frac{1}{2}\Rightarrow x=\frac{1}{4}$

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

8) (3 points) Where is the vertex of the quadratic function $f(x)=-\frac{14}{7}(x-6)^2-8$ located?

$(6,-8)$

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

1) $h=-3$ left 3

2) $a=-2$ multiply y-coords by -2 or reflect vertically & stretch

3) $k=4$ 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:

$f(0)=0^2+2\cdot0-3$

$=-3$

$(0,-3)$

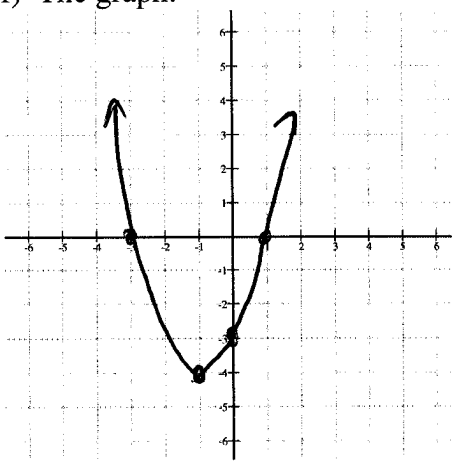
d) The domain:

$\mathbb{R}$

e) The range:

$[-4,\infty)$

f) The graph:



11) (3 points each) A large cupcake thrown into the air off of a 47-foot cliff follows a path given by the function $h(t) = -16t^2 + 32t + 47$ 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:

$t = \frac{-b}{2a} = \frac{-32}{2(-16)} = 1$ second

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

$h(1) = -16(1)^2 + 32(1) + 47$

$= 63$ feet

c) Find the time when the cupcake will hit the ground. Round your answer to two decimal places:

$-16t^2 + 32t + 47 = 0$

$t = \frac{-32 \pm \sqrt{32^2 - 4(-16)(47)}}{2(-16)} \approx$ 2.98 secs

~~-0.99~~

University research has shown that children actually hate small cupcakes.

12) (3 points each) For the function $f(x) = 2 \cdot 2^{x+3} + 4$...

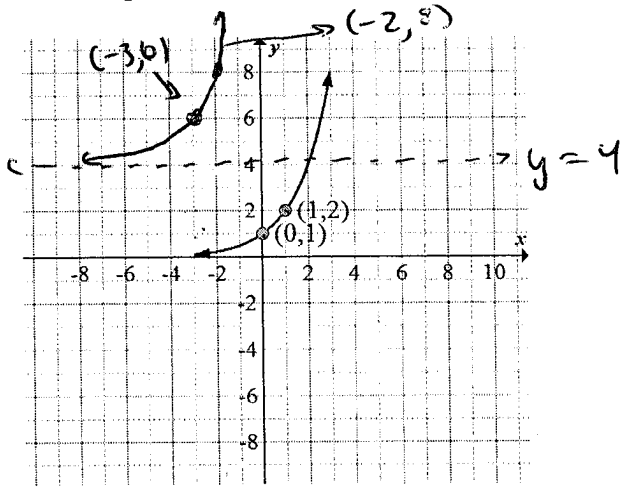
a) Describe the transformations necessary to sketch the graph

1) $h = -3$ left 3

2) $a = 2$ vertically stretched by 2 or multiply y-coordinates by 2

3) $k = 4$ up 4

b) Sketch a graph of the transformation using the graph $y = 2^x$ below. Be sure to label the transformed points and asymptote:



13) (5 points each) Solve for the variable in the equations:

a) $3^{2x-7} = 81$

$3^{2x-7} = 3^4$

$2x - 7 = 4$

$x = \frac{11}{2}$

b) $16^{5x-9} = 32^{12x+6}$

$(2^4)^{5x-9} = (2^5)^{12x+6}$

$2^{20x-36} = 2^{60x+30}$

$20x - 36 = 60x + 30$

$-66 = 40x$

$x = \frac{-66}{40} = -\frac{33}{20}$

25