1. (12pts) Simplify and write the answer so all exponents are positive:

a) $(2x^3y^{-2})^5(6x^{-3}y^{10})^{-2} =$

b) $\dfrac{(4u^4v^{-7})^3}{(12u^{-3}v^4)^2} =$

2. (4pts) Convert to scientific notation or a decimal number:

$5.7034 \times 10^{-4} =$ $1,034,000,000 =$

3. (8pts) Simplify and write in standard form:

a) $3x(x^2 - 3) - (4x - 5)(x + 3) =$

b) $(2x - 1)(3x^2 - x - 5) =$

4. (15pts) Use formulas to expand:

a) $(3x + 4)(3x - 4) =$

b) $(5x + 2y)^2 =$

c) $(3x - 10)^3 =$

5. (15pts) Factor the following. Use either a known formula or a factoring method.

a) $x^2 - 4x - 32 =$

b) $9x^2 + 3x - 2 =$

c) $8u^3 + 27 =$

6. (6pts) Fill in the appropriate prefix:

The bomb has the same destructive power as 4×10^6 tons of TNT, or 4_____tons.

The wavelength of blue light is about 400×10^{-9} meters, or 400_____meters.

The hard drive has a capacity of 20×10^{12} bytes, or 20_____bytes.

1. (16pts) Simplify.

$$\frac{3x-2}{4x^2-17x+4} - \frac{5}{x^2+3x-28} =$$

$$\frac{2+\dfrac{4}{x-5}}{x+\dfrac{6}{x-5}} =$$

2. (9pts) Simplify, showing intermediate steps.

$$\sqrt{108} =$$

$$125^{\frac{2}{3}} =$$

$$(-8)^{\frac{5}{3}} =$$

3. (14pts) Simplify. Express answers in terms of positive exponents.

$\sqrt[3]{48x^{21}y^{19}} =$

$$\frac{\left(256x^2 y^{-\frac{3}{2}}\right)^{\frac{1}{4}}}{8x^{\frac{5}{4}}\left(27y^{\frac{3}{4}}\right)^{-\frac{2}{3}}} =$$

4. (6pts) Rationalize the denominator.

$$\frac{\sqrt{5}-3}{1+2\sqrt{5}} =$$

5. (10pts) Simplify.

$(2+5i)(3-2i) =$

$$\frac{7+2i}{3-4i} =$$

6. (5pts) Simplify and justify your answer.

$i^{259} =$

1. (18pts) Solve the equations.

$10 + 2(3 - x) = 5 - 3(x - 2)$

$$\frac{x+1}{4} + \frac{3x-7}{10} = 2 + \frac{x-1}{5}$$

$$2 + \frac{2x+1}{x+4} = \frac{x-3}{x+4}$$

2. (14pts) You inherit $10,000 and can invest it in two different investments, one paying 6%, and the other paying 9%. If you wish to have 10,500 after 9 months, how much should you invest in each account?

3. (14pts) How many liters water must be mixed with 2 liters of a 22% solution of muriatic acid in order to get a 15% solution?

4. (14pts) Roommates Felipe and Raul like to ride their bicycles, and Felipe rides 2mph faster. If Felipe rides 7 miles in the same time that Raul rides 4 miles, how fast is each of them going?

1. (23pts) Solve the equations.

$6x^2 - 6x + 4 = x^2 + x$ $4x^4 - 11x^2 - 3 = 0$

$2x + 4 = x - \sqrt{6x + 51}$

2. (6pts) Solve by completing the square.

$x^2 - 10x + 5 = 8$

3. (4pts) Solve the equation.

$|3x - 1| = 13$

4. (12pts) Solve the inequalities. Draw your solution and write it in interval form.

$|2x - 5| \leq 7$ $\hspace{6cm}$ $|x + 5| \geq 2$

5. (15pts) A landscaper plans to cover two rectangular areas with stone tiles, of which she has enough to cover 20 square feet. One of the rectangles has width 2 feet more than the other, and both rectangles have lengths that are 1 foot more than their respective widths. Assuming the landscaper uses up all the tiles, what are the dimensions of the rectangles?

1. (19pts) Let $A = (-3, 0)$, $B = (3, 0)$ and $C = (0, 3)$.

a) Is the triangle ABC right, isosceles or equilateral?

b) Verify that the points A, B and C are all on the circle $x^2 + y^2 = 9$. Draw the circle.

c) Find a point D on the upper half of the circle other than A, B or C. Draw D in your picture. Show that the triangle ABD is a right triangle.

2. (10pts) Use your calculator to accurately sketch the graph of $y = x^3 - 4x^2 + 4x + 1$. Draw the graph here, and indicate the viewing window. Find all the $x-$ and $y-$intercepts (accuracy: 4 decimal points).

3. (7pts) Find the equation of the line (in form $y = mx + b$) that passes through points $(-1, -2)$ and $(2, 3)$.

4. (14pts) Find the equation of the line (in form $y = mx + b$) that is perpendicular to the line $3x - 4y = 5$, and passes through point $(-4, 0)$. Draw both lines.

5. (10pts) The equation $x^2 + y^2 + 6x - 8y = 0$ represents a circle. Find its center and radius and draw the circle.

1. (12pts) Use the graph of the function f
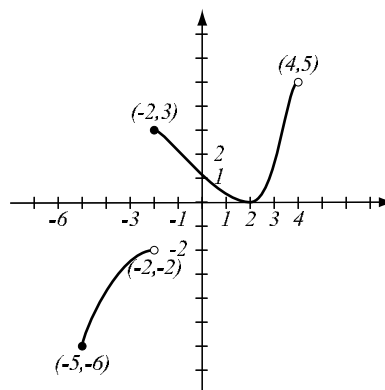at right to answer the following questions.

a) Find $f(4)$ and $f(-2)$.

b) What is the domain of f?

c) What is the range of f?

d) What are the solutions
   of the equation $f(x) = 4$?

e) Find intervals where $f(x) > 0$.

2. (6pts) Find the domain of $f(x) = \dfrac{5x - 1}{x^2 + x - 20}$. Write your answer in interval notation.

3. (14pts) Let $f(x) = x^4 - 9x^2 + 5$ (answer with 4 decimal points accuracy).
a) Use your graphing calculator to accurately draw the graph of f (on paper!). Indicate
scale on the graph.
b) Determine algebraically whether f is even, odd, or neither. Justify your answer further
by examining the graph.
c) Find where f has a local minimum and maximum.
d) Find the intervals of increase and decrease.

4. (6pts) Let $f(x) = x^2 + 4x - 9$. For this function, calculate the difference quotient $\dfrac{f(x+h) - f(x)}{h}$ and simplify.

5. (8pts) Sketch the graph of the piecewise-defined function:

$$f(x) = \begin{cases} -2x - 1, & \text{if } x < -2 \\ -\frac{1}{2}x + 2, & \text{if } -2 \leq x \leq 5. \end{cases}$$

6. (14pts) The graph of $f(x)$ is drawn below. On three separate graphs, sketch the graphs of the functions $f(x) + 3$, $f(2x)$ and $-f(x) + 1$ and label all the relevant points.
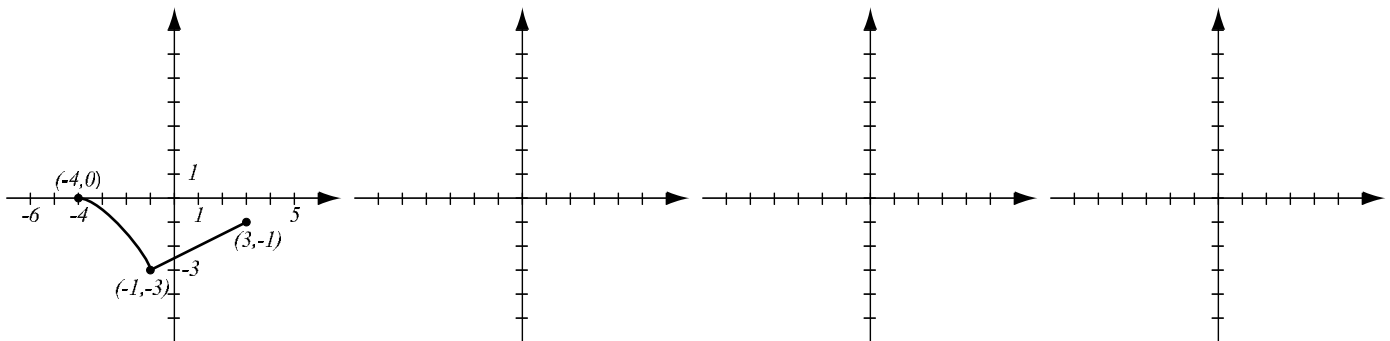
1. (20pts) Let $f(x) = \sqrt{x+3}$, $g(x) = \dfrac{x+1}{x-2}$. Find the following (simplify where possible):

$(f \cdot g)(x) =$

State the domain of $(f \cdot g)(x)$

$\dfrac{f}{g}(3) =$ $\hspace{8cm}$ $(f \circ g)(-2) =$

$(g \circ f)(x) =$ $\hspace{8cm}$ $(f \circ f)(x) =$

2. (12pts) Let $g(x) = \dfrac{x+1}{2x-9}$. Find the formula for g^{-1}. Find the domain and range of g.

3. (8pts) Consider the function $h(x) = \dfrac{x^2 + 4}{x^2 + 7}$. Find functions f and g so that $h(x) = f(g((x)))$. Find two different solutions to this problem, neither of which is the "stupid" one.

4. (6pts) The graph of a function f is given.
a) Is this function one-to-one? Justify.
b) If the function is one-to-one, find the graph of f^{-1}, labeling the relevant points.
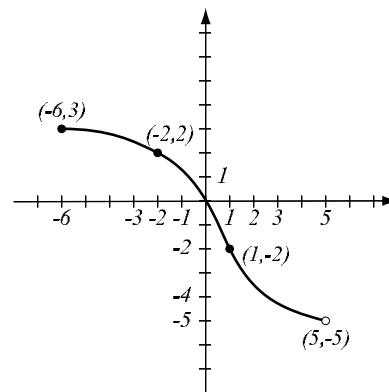
5. (14pts) The quadratic function $f(x) = -x^2 + 3x - 1$ is given. Do the following without using the calculator.
a) Find the x-intercepts of its graph, if any. Find the y-intercept.
b) Find the vertex of the graph.
c) Sketch the graph of the function.

1. (8pts) Evaluate without using the calculator:

$\log_8 256 =$ $\log_7 \frac{1}{49} =$ $\log_9 3 =$ $\log_c \sqrt[4]{c^3} =$

2. (4pts) Use your calculator to find $\log_3 15$ with accuracy 4 decimal places. Show how you obtained your number.

3. (11pts) Write as a sum and/or difference of logarithms. Express powers as factors. Simplify if possible.

$\log_6 \left(216(x^2 + 5x - 24)^3\right) =$

$\ln \dfrac{x^3 y^4}{x^{-2} y^8} =$

4. (14pts) Write as a single logarithm. Simplify if possible.

$\frac{1}{2} \log(49x^{\frac{3}{4}}) + \frac{1}{4} \log(16x^7) =$

$3 \log_b(x^2 + 4x - 21) - 2 \log_b(x + 7) - 5 \log_b(x - 3) =$

5. (3pts) Find the domain of $f(x) = \log_{17}(7 - 3x)$.

6. (12pts) Solve the equations.

$8^{2x+1} = 64^{3x-4}$
$\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad 3^{2x} = 2^{3x-5}$

7. (8pts) If you invest \$2,000 in an account bearing 3%, compounded monthly, how long will it take until there is \$3,000 in the account?