

1. (6pts) Simplify and write the answer so all exponents are positive:

a) $(x^{-3}y^6)^3x^4y^{-5} =$

b) $\frac{4x^{-2}(3y)^2}{(6x^{-3}y^4)^2} =$

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

5353789 =

$1.5917 \times 10^{-4} =$

3. (4pts) Simplify and write in standard form:

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

b) $(x + 4)(x - 4) - 3x(2x + 1) =$

4. (8pts) Use formulas to expand:

a) $(2x - 7)^2 =$

b) $(4x - 9)(4x + 9) =$

c) $(2x + 5)^3 =$

5. (8pts) Factor the following. Use either a known formula or a factoring method.

a) $x^2 + 4x - 21 =$

b) $9x^2 - 12x + 5 =$

c) $x^3 - 216 =$

6. (2pts) Verify the formula for the sum of cubes by multiplying out the factors:

$(x + a)(x^2 - xa + a^2) =$

1. (8pts) Simplify.

$$\frac{2x - 3}{x^2 + 2x - 24} - \frac{x - 7}{x^2 + 4x - 12} =$$

$$\frac{\frac{3x}{x+4} - 1}{2 + \frac{16x-8}{x^2-16}} =$$

2. (6pts) Simplify, showing intermediate steps.

$$\sqrt{360} =$$

$$16^{\frac{7}{4}} =$$

$$(-27)^{\frac{4}{3}}$$

3. (7pts) Simplify. Express answers in terms of positive exponents.

$$\sqrt[5]{64x^{10}y^{17}} =$$

$$\frac{\left(4x^{\frac{1}{3}}y^{\frac{3}{4}}\right)^{\frac{5}{2}}}{\left(6x^{-\frac{2}{3}}y^{\frac{1}{8}}\right)^2} =$$

4. (2pts) Rationalize the denominator.

$$\frac{3 + 5\sqrt{2}}{7 - \sqrt{2}} =$$

5. (5pts) Simplify.

$$(3 - 2i)(7 + 5i) =$$

$$\frac{-7 + i}{5 + 2i} =$$

6. (2pts) Simplify and justify your answer.

$$i^{218} =$$

1. (5pts) Solve the equations.

$$3x - (x + 4) = 5(x - 8) + 3$$

$$2 + \frac{6x + 1}{x - 4} = \frac{7x - 3}{x - 4}$$

2. (6pts) Solve the equations.

$$2x^2 - 3x = x^2 + x + 21$$

$$3x^2 = 6x - 8$$

3. (3pts) Solve by completing the square.

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

4. (8pts) How many gallons of pure alcohol must be mixed with 5 gallons of a 20% alcohol solution in order to get a 50% alcohol solution?

5. (8pts) An airplane averages an airspeed of 130mph. Due to a constant wind, it takes the plane 2 hours to fly to a place, but only 1hr and 15 minutes to return from it.

a) Find the wind speed.

b) Find how far the plane flew one-way.

1. (8pts) Solve the inequalities. Draw your solution and write it in interval form.

$$3 \leq 5 + 4x < 7$$

$$|x - 5| \geq 7$$

2. (6pts) Find all the solutions of the equation.

$$|x^2 + x| = 12$$

3. (4pts) The weight of packages of sugar coming from a factory is $32(\pm 0.35)$ ounces. Write an absolute value inequality about weight w that expresses this fact and solve this inequality.

4. (6pts) Let $A = (-3, 1)$, $B = (1, 2)$, $C = (-1, 9)$. Sketch the triangle ABC in the coordinate system and determine (algebraically) whether it is a right triangle.

5. (6pts) Use your graphing calculator to accurately draw the graph (on paper!) of $y = x^3 + 5x^2 - 17x - 5$. Determine the x - and y -intercepts (with 4-decimal-point accuracy) and indicate the scale on the graph.

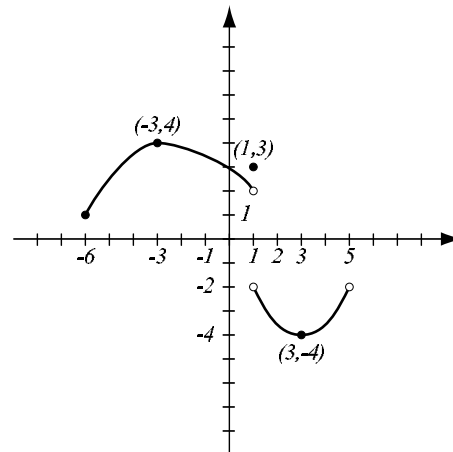
1. (4pts) Find the equation of the line (in form $y = mx + b$) that passes through points $(3, -1)$ and $(7, 1)$.

2. (7pts) Find the equation of the line (in form $y = mx + b$) that is perpendicular to the line $3x + 5y = 6$, and passes through the x -intercept of that line. Draw both lines.

3. (3pts) Let $f(x) = \frac{3x - 4}{\sqrt{7 - 4x}}$. Write the domain of this function in interval notation.

4. (7pts) Use the graph of the function f at right to answer the following questions.

- What is the domain of f ?
- What is the range of f ?
- Find $f(-3)$ and $f(1)$.
- What are the solutions of the equation $f(x) = 2$?
- Find intervals where $f(x) < 0$.



5. (4pts) If $g(x) = x^2 - 5x + 7$, find $g(x + 3) - g(x + h)$.

6. (5pts) a) Draw a picture of any circle that is tangent to both x and y axes and write the equation of the circle.
- b) Find the equation of the circle that is tangent to both the x and the y axis, and whose center lies on the line $y = -2x - 6$. Draw a picture.

1. (5pts) Let $f(x) = x^4 - 25x^2 + 7$.

- a) Algebraically determine whether this function is even, odd or neither.
- b) Sketch the graph and comment how it supports your conclusion from a).

2. (7pts) Use your graphing calculator to accurately draw the graph of (on paper!) of $f(x) = x^4 - 9x^3 + 11x^2 + 4x$. Remember to put scale on the graph and find the following (with 4-decimal-point accuracy):

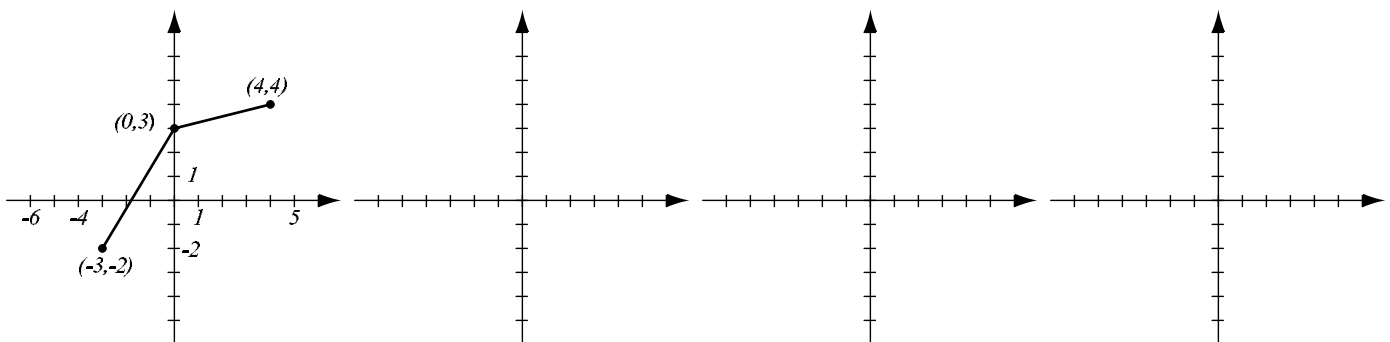
- a) Where f has a local maximum and minimum.
- b) The intervals of increase and decrease.

3. (5pts) Sketch the graph of the piecewise-defined function:

$$f(x) = \begin{cases} 2x - 7, & \text{if } x \leq 1 \\ x + 1, & \text{if } 1 < x < 4. \end{cases}$$

4. (5pts) Draw the graph of $g(x) = 2\sqrt{x+3} - 5$ by starting with the graph of \sqrt{x} and applying transformations. Explain how you transform the graph at every step.

5. (8pts) The graph of $f(x)$ is drawn below. On three separate graphs, sketch the graphs of the functions $f(x) - 4$, $f(3x)$ and $-f(x+1)$ and label all the relevant points.



1. (9pts) Let $f(x) = x^2 + 5x - 7$, $g(x) = 3x + 2$. Find the following functions (simplify where possible):

$$(f + g)(x) = \qquad \qquad \qquad \frac{f}{g}(3) =$$

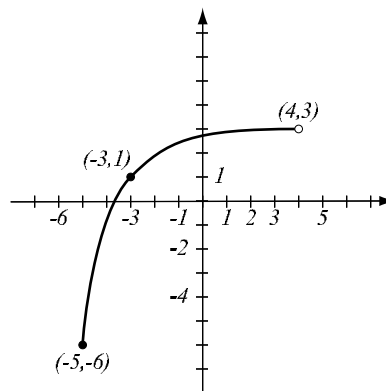
$$(f \circ g)(0) = \qquad \qquad \qquad (f \circ g)(x) =$$

$$(g \circ g)(x) = \qquad \qquad \qquad (g \circ f)(x) =$$

2. (5pts) Consider the function $h(x) = \frac{4}{x + \sqrt{x}}$. Find functions f and g so that $h(x) = (f \circ g)(x)$. Find two different solutions to this problem, neither of which is the “stupid” one.

3. (5pts) The graph of a function f is given.

- Is this function one-to-one? Justify.
- If the function is one-to-one, find the graph of f^{-1} , labeling the relevant points.



4. (6pts) Let $g(x) = \frac{2x}{x-7}$. Find the formula for g^{-1} and find the domain and range of g .

5. (5pts) Suppose you are fencing in a circular area for your dog. Let x be the length of fencing you bought.

- Express the radius of the circle r as a function of x .
- Express the area of the enclosure first as a function of r , then as a function of x .

1. (7pts) The quadratic function $f(x) = -x^2 - x + 6$ is given. Do the following without using the calculator.

- Find the x -intercepts of its graph, if any.
- Find the vertex of the graph.
- Sketch the graph of the function.

2. (13pts) Consider the polynomial $f(x) = x^4 - 7x^2 + 10$.

- Find the y - and x -intercepts algebraically. (Recall skills from section 1.4.)
- Use your calculator to draw the graph of the function (on paper!).
- Find all the turning points (4 decimal points accuracy).
- Does the polynomial have the maximal possible number of x -intercepts for its degree?
How about the maximal possible number of turning points?
- What is the range of f ?

3. (10pts) A rancher has 30,000 linear feet of fencing and wants to enclose a rectangular field and divide it into four equal pastures with three fences parallel to one of the sides of the field (see picture in problem 62, pg. 339, and draw it here).

a) Write the area as a function of the length of one of the sides of the rectangle.

b) Sketch the graph of this function.

c) What dimensions of the rectangle give the largest area? What is the largest area?