

# Final Exam Review 130

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\* If you are enrolled in Math 130A, some of the materials covered will exceed your course and it is your responsibility to focus on content relating to your class **only**.

\*\* If you are enrolled in Math 130B, remember that the Final Exam for Math 130B reflects materials from 130A and 130B.

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## Section 1: Simplify Expressions

1. Perform the operations, simplify completely. Write answers with positive exponents.

a)  $25^{\frac{1}{3}} \cdot 25^{\frac{2}{3}}$

b)  $25^{\frac{3}{2}}$

c)  $x^{-1} + x^{-2}$

d)  $x^{\frac{2}{5}} \cdot x^{\frac{3}{4}}$

e)  $\left(\frac{5x^2y^{-3}z^{-6}}{2x^{-1}y^{-3}z^3}\right)^{-2}$

f)  $\left(\frac{4x^{\frac{1}{2}}y^{\frac{2}{3}}z}{y^{\frac{4}{5}}z}\right)^{\frac{1}{4}}$

2. Perform the operations, simplify completely.

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

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

3. Divide. Use long division when appropriate.

a)  $\frac{2x^3 - 3x^2 - 5x + 7}{2x + 3}$

b)  $\frac{2x^3 - 3x^2 - 6x + 7}{2x}$

4. Factor completely.

a)  $x^4 - 16$

b)  $8z^3 + 1$

c)  $y^3 + 3y^2 - y - 3$

d)  $3x^2 - 13xy + 12y^2$

e)  $15x^2 + 14x - 8$

5. Perform the operations, simplify completely. Write your answer in lowest terms with the denominator factored.

a)  $\frac{x^2 + 4x}{x^2 - 16}$

b)  $\frac{2x - 5}{2x^2 - 7x - 4} - \frac{x + 4}{x^2 - x - 12}$

c)  $\frac{3x^2 - x - 4}{4x^2 + 5x + 1} \cdot \frac{2x^2 - 5x - 12}{6x^2 + x - 12}$

d)  $\frac{x - 3}{30x^2 + 7x - 2} \div \frac{5x^2 - 13x - 6}{6x - 1}$

e)  $\frac{x + \frac{6}{5}}{3 + \frac{x}{y}}$

6. Simplify completely. Assume all variables are non-negative.

a)  $\sqrt{36}$

b)  $-\sqrt{36}$

c)  $\sqrt{-36}$

d)  $\sqrt[3]{-27}$

e)  $-\sqrt[3]{-27}$

f)  $\sqrt{80x^7yz^{20}}$

g)  $\frac{\sqrt{8x^3y^5z}}{\sqrt{2xy^3z}}$

7. Perform the operations, simplify completely. Assume all variables are non-negative. (Note:  $i = \sqrt{-1}$ )

a)  $\sqrt{3x} \cdot \sqrt{27x}$

b)  $(2\sqrt{3} - \sqrt{5})(\sqrt{2} + 3\sqrt{5})$

c)  $(2 + \sqrt{3})^2$

d)  $(\sqrt{3} - 3)(\sqrt{3} + 3)$

e)  $(2 - 3i) + (4 - 5i)$

f)  $(2 - 3i) - (4 - 5i)$

g)  $(2 - 3i) \cdot (4 - 5i)$

8. Simplify completely. Rationalize the denominator. Assume all variables are non-negative. (Note:  $i = \sqrt{-1}$ )

a)  $\frac{5}{\sqrt{3}}$

b)  $\frac{14}{3 - \sqrt{2}}$

c)  $\frac{2 + 3\sqrt{7}}{3 - \sqrt{7}}$

d)  $\sqrt[3]{\frac{2}{3x^2}}$

e)  $\frac{2 + 3i}{5i}$

f)  $\frac{2 + 3i}{4 - 5i}$

9. Simplify completely.

a)  $\log_9(9^{10})$

b)  $6^{\log_6(3)}$

c)  $5^{2\log_5(7)}$

10. Expand using properties of logs

$$\log \left[ \frac{5(2x+3)^3}{y^2} \right]$$

11. Use properties of logs to write as a single log.

$$3\log(x-1) - 2\log(x) + \log(6)$$

## Section 2: Solve Equations & Inequalities

12. Solve the inequality, sketch the solution, and write in interval notation.

a)  $4 \leq 6 - 3x < 12$

b)  $|7 - 2x| - 13 \geq -4$



Interval Notation:

Interval Notation:

13. Solve each system of equations.

a)  $5x - y = -15$   
 $2x + 3y = 28$

b)  $4x - 3y = 8$   
 $5x + 6y = 10$

c)  $2x - y + 3z = 13$   
 $5x + 2y - z = -2$   
 $x - 3y + 2z = 13$

14. Solve.

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

b)  $10x^2 + 7x = 12$

c)  $x^2 - 6x + 12 = 0$

d)  $4x^2 + 8x - 16 = 0$

15. Solve and check your answer.

a)  $\frac{2}{x} + \frac{1}{2} = \frac{5}{2x}$

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

c)  $x - 3 = \frac{-7x+14}{x-2}$

d)  $\sqrt{x+3} = 5$

e)  $\sqrt{x+3} + 5 = 0$

f)  $x + 2 = \sqrt{2x+28}$

g)  $-4 + \sqrt{5x+56} = x$

h)  $\sqrt[3]{x-15} = 3$

16. Solve.

a)  $x = \log_3(81)$

b)  $\log_2(y) = 5$

c)  $\log_6(x) + \log_6(3x+7) = 1$

d)  $\log(x) + \log(x-1) = \log(6)$

e)  $5^{x+1} = 25$

f)  $7 = 2^{x+3}$

g)  $42 = 7e^{5x}$

17. Solve for the specified variable.

a)  $\frac{1}{z} = \frac{2}{9} + \frac{3}{y}$ , for  $y$

b)  $A = P + P \cdot r \cdot t$ , for  $P$

c)  $A = LW + 2LH + 2WH$ , for  $H$

### Section 3: Application Problems

18. White vinegar purchased in the supermarket generally has 5% acidity level. The chef wants a special 8% distilled vinegar which she creates by mixing the 5% solution with a 12% vinegar solution that she purchased by mail. How many ounces of the 12% vinegar solution should she add to 40 ounces of the 5% vinegar solution to get the 8% vinegar solution?
19. Alcohol you purchase at the drug store is 70% pure alcohol. John wants to use a mixture of 5.6% alcohol in his car window washer. How much of the 70% alcohol should he mix with water to make 50 ounces of 5.6% alcohol mixture?
20. Ty can ride his bike to work in  $\frac{3}{4}$  hour. If he drives his car to work, the trip takes  $\frac{1}{6}$  hour. If Ty drives his car an average of 14 miles per hour faster than he rides his bike, determine the distance he travels to work.
21. Train A leaves the station traveling at 30 mph. Three hours later train B, traveling at 40 mph leaves the station, in the same direction on a parallel track. How long does it take train B to catch train A?
22. A moving sidewalk moves at a speed of 2.0 feet per second. Walking on the moving sidewalk, Nancy walks 120 feet in the same amount of time that it takes her to walk 56 feet without the moving sidewalk. How fast does Nancy walk?
23. One car travels 3 mph faster than another. In the time it takes the slower car to travel 270 miles, the faster car travels 288 miles. Find the speed of the slower car.
24. The bookstore sells both regular and jumbo size boxes of See's candy for the holidays. A regular size box costs \$9, while the jumbo size box costs \$12. There were 200 orders of the boxes of candy, which totaled \$2040. How many regular size boxes were ordered?
25. The owner of a nursery wants to mix some fertilizer worth \$60 per bag with some worth \$20 per bag to obtain 50 bags of mixture worth \$38.40 per bag. How many bags of each type should he use?
26. The sum of the measure of the angles is 180 degrees. The smallest angle of a given triangle has a measure that is  $\frac{1}{2}$  the measure of the second smallest angle. The largest angle has a measure that is 36 degrees less than three times of the second smallest angle. Find the measure of the second smallest angle.

27. The tap can FILL a tank in 20 minutes, while the drain will EMPTY the tank in 30 minutes. If the tank starts empty, with the drain pen, how long after the tap is turned on will the tank be full?

28. A coconut is thrown upward with a speed of 48 feet per second from the top edge of a cliff 64 feet high. The height,  $h$ , of the coconut above the ground at any time,  $t$ , is given by the equation  $h(t) = -16t^2 + 48t + 64$ .

a) How high is the coconut after 2 seconds?

b) Find the time it takes the coconut to hit the ground?

29. How long would it take to double your money from 5000 to 10000 in an investment which earns 7% interest, if the interest is:

a) Compounded Monthly

$$P = P_0 \left( 1 + \frac{r}{n} \right)^{n \cdot t}$$

b) Compounded Continuously

$$P = P_0 e^{r \cdot t}$$

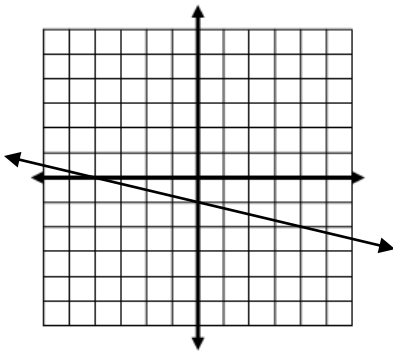
## Section 4: Graphs and Functions

30. Find the equation of each line. Write in  $y = mx + b$  form.

a) The line passing through the points (1, -2) and (5, 4).

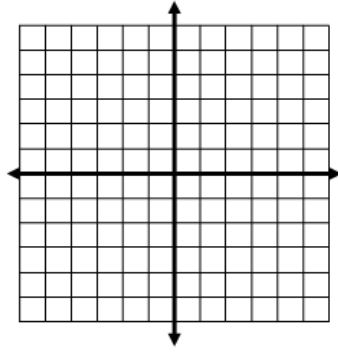
b) The line passing through the point (-2, 3), with slope,  $m = -2$ .

c) The line shown on this graph:

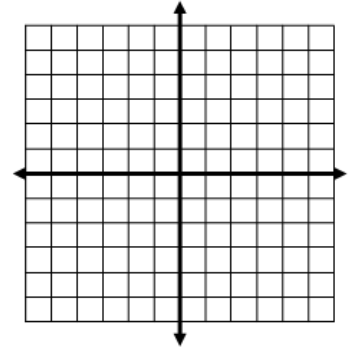


31. Graph each equation or inequality.

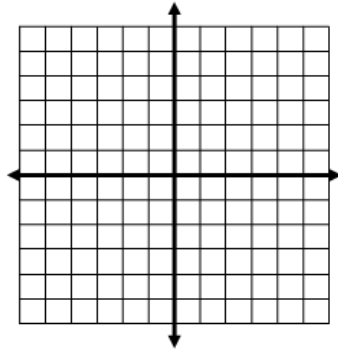
a)  $y = \frac{2}{3}x - 4$



b) the line through  $(-2, 3)$  with slope  $m = -\frac{3}{4}$



c)  $4x - 6y \geq 12$



32. Sketch the graph of each equation. Answer all related questions.

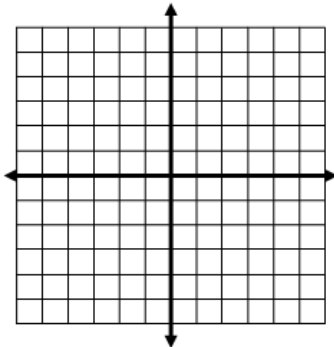
a)  $f(x) = -x^2 + 3x + 10$

i) Vertex: (\_\_\_\_, \_\_\_\_)

ii) y-intercept: \_\_\_\_\_

iii) x-intercept(s) (if they exist): \_\_\_\_\_

iv) Graph



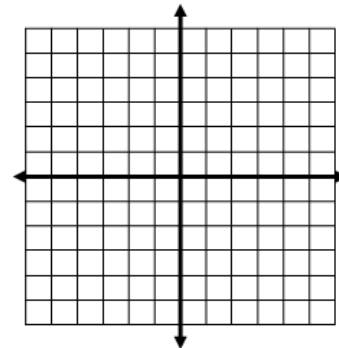
b)  $f(x) = \frac{1}{3}(x-4)^2 + 2$

i) Vertex: (\_\_\_\_, \_\_\_\_)

ii) y-intercept: \_\_\_\_\_

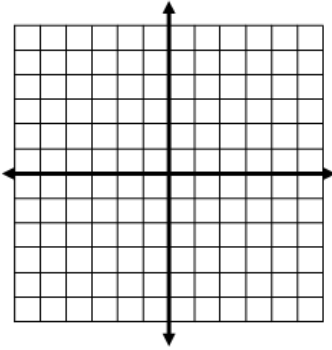
iii) x-intercept(s) (if they exist): \_\_\_\_\_

iv) Graph

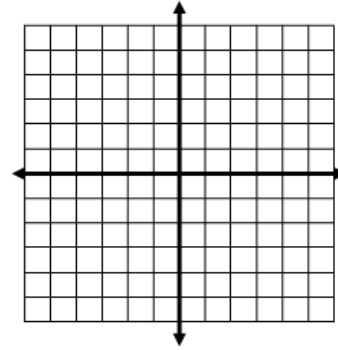


33. Sketch the following equations, identify any important features.

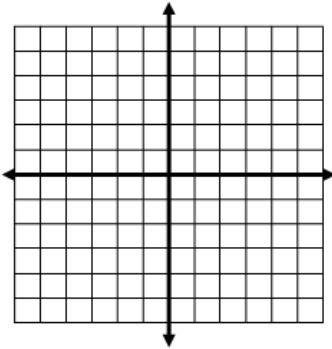
a)  $\frac{x^2}{25} - \frac{y^2}{4} = 1$



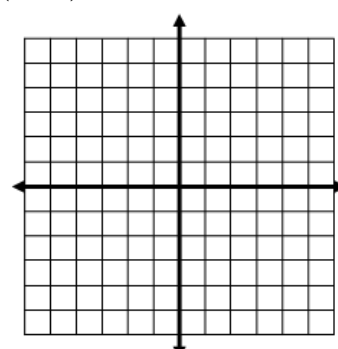
b)  $\frac{x^2}{25} + \frac{y^2}{4} = 1$



c)  $x^2 + 4x + y^2 - 6y - 36 = 0$

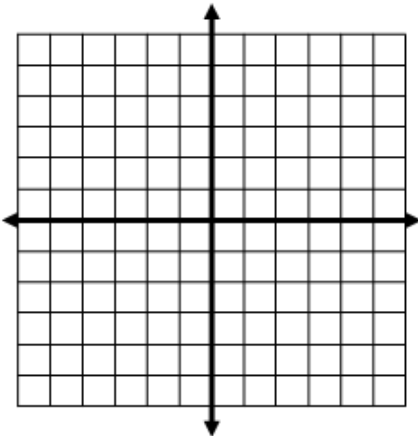


d)  $(x-2)^2 + (y-1)^2 = 25$



34. Graph both functions on the same axes. Label each curve and any important features.

Function 1:  $y = 2^x$       Function 2:  $y = \log_2(x)$



35. Given  $f(x) = 2x - 5$ ,  $g(x) = 4x + 2$ , and  $h(x) = 3x - 4$ . Find each of the following:

a)  $(f \circ g)(2)$

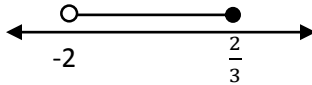
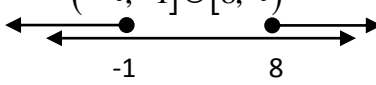
b)  $h^{-1}(x)$



## Solutions: Section 1 – Simplify Expressions

1. a) 25  
b) 125  
c)  $\frac{x+1}{x^2}$   
d)  $x^{\frac{23}{20}}$   
e)  $\frac{4z^{18}}{25x^6}$   
f)  $\frac{4^{\frac{1}{4}}x^{\frac{1}{8}}}{y^{\frac{1}{30}}}$
2. a)  $x^3 + 8x^2 + 11x - 20$   
b)  $9x^2 - 30x + 25$
3. a) Long Division  
 $x^2 - 3x + 2 + \frac{1}{2x+3}$   
b)  $x^2 - \frac{3}{2}x - 3 + \frac{7}{2x}$
4. a) Difference of Squares  
 $(x^2 + 4)(x+2)(x-2)$   
b) Sum of Cubes  
 $(2z+1)(4z^2 - 2z + 1)$   
c)  $(y+3)(y+1)(y-1)$   
d)  $(3x-4y)(x-3y)$   
e)  $(5x-2)(3x+4)$
5. a)  $\frac{x}{x-4}$   
b)  $\frac{-8x-19}{(2x+1)(x+3)(x-4)}$   
c)  $\frac{x-4}{4x+1}$   
d)  $\frac{1}{(5x+2)^2}$   
e)  $\frac{y(x^2+6)}{x(3y+5)}$
6. a) 6  
b) -6  
c)  $6i$   
d) -3  
e) 3  
f)  $4x^3z^{10}\sqrt{5xy}$   
g)  $2xy$
7. a)  $9x$   
b)  $2\sqrt{6} + 6\sqrt{15} - \sqrt{10} - 15$   
c)  $7 + 4\sqrt{3}$   
d) -6  
e)  $6 - 8i$   
f)  $-2 + 2i$   
g)  $-7 - 22i$
8. a)  $\frac{5\sqrt{3}}{3}$   
b)  $6 + 2\sqrt{2}$   
c)  $\frac{27 + 11\sqrt{7}}{2}$   
d)  $\frac{\sqrt[3]{18x}}{3x}$   
e)  $\frac{3-2i}{5}$   
f)  $\frac{-7+22i}{41}$
9. a) 10  
b) 3  
c) 49
10.  $\log(5) + 3\log(2x+3) - 2\log(y)$
11.  $\log\left(\frac{(x-1)^3 \cdot 6}{x^2}\right)$

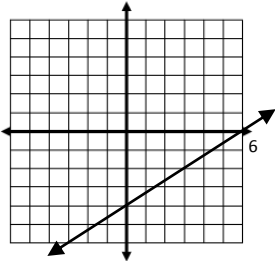
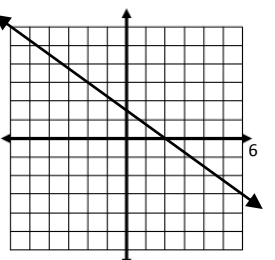
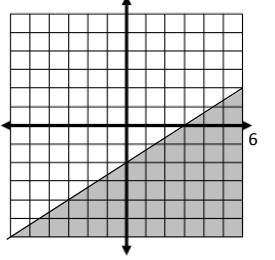
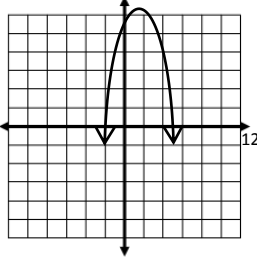
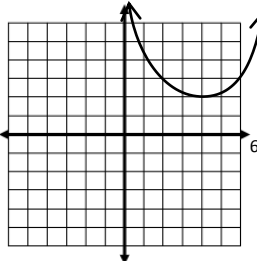
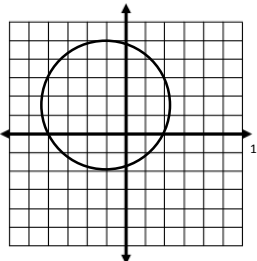
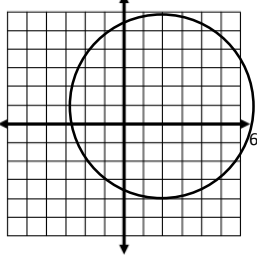
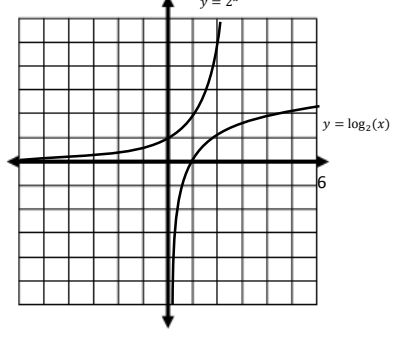
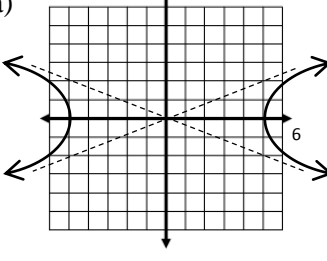
## Solutions: Section 2 – Solve Equations

12. a)  $\frac{2}{3} \geq x > -2$   
 $\left(-2, \frac{2}{3}\right]$   
  
b)  $x \leq -1$  or  $x \geq 8$   
 $(-\infty, -1] \cup [8, \infty)$   

13. a) (-1, 10)  
b) (2, 0)  
c) (1, -2, 3)
14. a)  $\frac{3}{2}, -1$   
b)  $\frac{4}{5}, -\frac{3}{2}$   
c)  $3 \pm i\sqrt{3}$   
d)  $-1 \pm \sqrt{5}$
15. a) 1  
b) 4  
c) -4  
d) 22  
e) No Solution  
f) 4  
g) 5  
h) 42
16. a) 4  
b) 32  
c)  $\frac{2}{3}$   
d) 3  
e) 1  
f)  $\frac{\log(7)}{\log(2)} - 3$   
g)  $\frac{\ln(6)}{5}$
17. a)  $y = \frac{27z}{9-2z}$   
b)  $P = \frac{A}{1+rt}$   
c)  $H = \frac{A-LW}{2L+2W}$

## Solutions: Section 3 – Application Problems

18. 30 ounces
19. 4 ounces
20. 3 miles
21. 9 hours
22.  $\frac{7}{4}$  or 1.75 feet per second
23. 45 mph
24. 120 regular boxes
25. 23 bags at \$60 each and 27 bags at \$20 each
26. 48 degrees
27. a) 96 feet  
b) 4 seconds
28. 60 minutes
29. a)  $t = \frac{\log(2)}{12 \cdot \log\left(1 + \frac{0.07}{12}\right)}$   
b)  $t = \frac{\ln(2)}{0.07}$

## Solutions: Section 4 – Graphs and Functions

30. a)  $y = \frac{3}{2}x - \frac{7}{2}$   
b)  $y = -2x - 1$   
c)  $y = -\frac{1}{4}x - 1$
31. a) 
- b) 
- c) 
32. a) i)  $\left(\frac{3}{2}, \frac{49}{4}\right)$   
ii) (0, 10)  
iii) (-2, 0), (5, 0)
- 
- b) i) (4, 2)  
ii)  $\left(0, \frac{22}{3}\right)$   
iii) None
- 
33. c) 
- d) 
34. 
35. a) 15  
b)  $h^{-1}(x) = \frac{x+4}{3}$
33. a) 
- b) 