

## Winter Break Assignment (odd #'s ONLY)

**Due: January 3, 2017**

### I. Factoring and expanding polynomials

Factor the following polynomials:

- $15a^3b^2 - 45a^2b^3 - 60a^2b$
- $7x^3y^3 + 21x^2y^2 - 10x^3y^2 - 30x^2y$
- $6x^4y^4 - 6x^3y^2 + 8xy^2 - 8$
- $2x^2 - 7xy + 6y^2$
- $y^4 + y^2 - 6$
- $7x^3 + 56y^3$
- $81r^4 - 16s^4$
- $(x + y)^2 + 2(x + y) + 1$

Expand the following:

- $(x + 1)(x - 1)(x - 3)$
- $(2x + 3y)^2$
- $(\sqrt{3}x + \sqrt{3})(\sqrt{6}x - \sqrt{6})$
- $(x^2 - 2x + 3)^2$
- $(x + 1)^5$
- $(x - 1)^6$

### II. Simplification of Rational Algebraic Expressions

Simplify the following. Assume all variables are larger than zero.

- $3^2 + 5 - \sqrt{4} + 4^0$
- $9 \div 3 \cdot 5 - 8 \div 2 + 27$
- $\sqrt{\frac{81}{x^4}}$
- $2\sqrt{18} - 5\sqrt{32} + 7\sqrt{162}$
- $\frac{6x - 18}{3x^2 + 2x - 8} \cdot \frac{12x - 16}{4x - 12}$

### III. Solving Equations

#### A. Linear

- $3 - 2(x - 1) = x - 10$
- $\frac{x}{2} - \frac{x}{7} = 1$
- $y(y + 2) = y^2 - 6$
- $2[x - (1 - 3x)] = 3(x + 1)$

#### B. Quadratic & Polynomial

- $\left(y - \frac{8}{3}\right)\left(y + \frac{2}{3}\right) = 0$
- $2x^3 - 4x^2 - 30x = 0$
- $27x^3 = 1$
- $(x - 3)(x + 6) = 9x + 22$
- $t^2 + t + 1 = 0$
- $3x^3 = 24$
- $(x + 1)^2 + x^2 = 25$
- $5y^2 - y = 1$

**C. Rational**

1.  $\frac{1}{y-1} + \frac{2}{y+1} = 0$

2.  $\frac{2}{x-3} - \frac{3}{x+3} = \frac{12}{x^2-9}$

3.  $\frac{1}{6-x} + \frac{2}{x+3} = \frac{5x}{x^2-3x-18}$

4.  $\frac{11}{x^2-25} - \frac{2}{x-5} = \frac{1}{x+5}$

5.  $\frac{1}{a} = \frac{-6}{a^2+5}$

6.  $\frac{-1}{x^2-3x} = \frac{1}{x} + \frac{x}{x-3}$

**E. Exponential**

1.  $10^x = 1000$

2.  $10^{3x+5} = 100$

3.  $2^{x+1} = \frac{1}{8}$

4.  $3^{x^2}(9^x) = \frac{1}{3}$

5.  $2^{x^2}(4^{2x}) = \frac{1}{8}$

**F. Logarithmic**

1.  $\log_2(x+5) = \log_2(1-5x)$

2.  $2\log_3(x+1) = \log_3(4x)$

3.  $\log_2(x+1) + \log_2(x-1) = 3$

4.  $\ln x + \ln(2x+1) = 0$

5.  $\ln x + \ln(x+2) = \ln 3$

6.  $3^{2x} = 4^{x+1}$

**G. Radicals**

1.  $4\sqrt{2y-1} - 2 = 0$

2.  $\sqrt{2x+1} + 5 = 8$

3.  $\sqrt{5x-1} - 2\sqrt{x+1} = 0$

4.  $\sqrt{x^2+9} + x + 1 = 0$

5.  $\sqrt[3]{3x+2} + 4 = 6$

6.  $\sqrt[4]{w^2+7} = 2$

**V. Lines & Regions**

1. Find the x and y-intercepts, the slope, and graph  $6x + 5y = 30$ .
2. Find the x and y-intercepts, the slope, and graph  $x = 3$ .
3. Find the x and y-intercepts, the slope, and graph  $y = -4$ .
4. Write in slope-intercept form the line that passes through the points (4, 6) and (-4, 2).
5. Write in slope-intercept form the line perpendicular to the graph of  $4x - y = -1$  and containing the point (2, 3).
6. Graph the solution set of  $x - y \geq 2$ .
7. Graph the solution set of  $-x + 3y < -6$ .

## VII. Exponents and Radicals

Simplify. Assume all variables are  $>0$ . Rationalize the denominators when needed.

1.  $\sqrt[3]{-8x^3}$

2.  $5\sqrt{147} - 4\sqrt{48}$

3.  $\sqrt{5}(\sqrt{15} - \sqrt{3})$

4.  $\left(\frac{x^{\frac{2}{3}}y^{-\frac{4}{3}}}{x^{-\frac{5}{3}}}\right)^3$

5.  $\sqrt[3]{\frac{40x^4}{y^9}}$

6.  $\left(\frac{54a^{-6}b^2}{9a^{-3}b^8}\right)^{-2}$

7.  $\frac{\sqrt[3]{27a^3}}{\sqrt[3]{2a^2b^2}}$

8.  $\frac{2}{\sqrt{5} - \sqrt{3}}$

9.  $\frac{x}{\sqrt{x} + 3}$

## VIII. Complex Numbers

Perform the indicated operation and simplify.

1.  $\sqrt{-16} - 4\sqrt{-9}$

2.  $\sqrt{-16} \cdot \sqrt{-9}$

3.  $\frac{\sqrt{-16}}{\sqrt{-9}}$

4.  $(4 - 3i)(4 + 3i)$

5.  $(4 - 3i)^2$

6.  $i^{25}$

7.  $\frac{3 - 2i}{4 + 5i}$

## IX. Exponential Functions and Logarithms

1. Graph:  $f(x) = 3^x + 1$

2. Graph:  $g(x) = 2^{x-1}$

3. Express  $8^{-2} = \frac{1}{64}$  in logarithmic form.

4. Express  $\log_5 25 = 2$  in exponential form.

5. Solve:  $\log_2 x = 4$

6. Solve:  $\log_x 9 = 2$

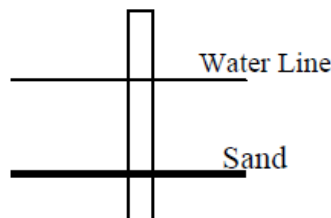
7. Graph:  $h(x) = \log_3 x$

8. Use the properties of logarithms to expand as much as possible:  $\log_4 \frac{3}{y}$

9. How long will it take \$850 to be worth \$1,000 if it is invested at 12% interest compounded quarterly?

## XI. Story Problems

1. Sam made \$10 more than twice what Pete earned in one month. If together they earned \$760, how much did each earn that month?
2. A woman burns up three times as many calories running as she does when walking the same distance. If she runs 2 miles and walks 5 miles to burn up a total of 770 calories, how many calories does she burn up while running 1 mile?
3. A pole is standing in a small lake. If one-sixth of the length of the pole is in the sand at the bottom of the lake, 25 ft are in the water, and two-thirds of the total length is in the air above the water, what is the length of the pole?



## XIII. Sequence & Series

1. Write out the first four terms of the sequence whose general term is  $a_n = 3n - 2$ .
2. Write out the first four terms of the sequence whose general term is  $a_n = n^2 - 1$ .
3. Write out the first four terms of the sequence whose general term is  $a_n = 2^n + 1$ .
4. Find the general term for the following sequence: 2, 5, 8, 11, 14, 17, ...
5. Find the general term for the following sequence: 4, 2, 1,  $\frac{1}{2}$ ,  $\frac{1}{4}$ , ...
6. Find the sum:  $\sum_{k=0}^6 2k - 1$
7. Expand the following:  $\sum_{k=0}^4 \binom{4}{k} x^k y^{4-k}$

## XIV. Functions

Let  $f(x) = 2x + 9$  and  $g(x) = 16 - x^2$ . Find the following.

1.  $f(-3) + g(2)$
2.  $f(5) - g(4)$
3.  $f(-1) \cdot g(-2)$
4.  $\frac{f(5)}{g(5)}$
5.  $(g \circ f)(-2)$
6.  $f(g(x))$
7.  $f^{-1}(2)$
8.  $f(f^{-1}(3))$