

Standards for the Math 118 Departmental Exam *November 5, 2009*

1. Evaluate polynomial and rational expressions given a value for each variable. For example evaluate:

(a) $ab - 3ab^2$ if $a = -2$ and $b = -3$ (b) $\frac{x+y}{x-y}$ if $x = -3$ and $y = -4$

2. Write a rational expression so that powers of the same base are combined and all exponents are positive. For example write with positive exponents, combine, and reduce:

(a) $(3x^{-2}y^4)^{-2}$ (b) $\frac{m-3n^2m-6}{m^5n^{-8}}$

3. Solve linear equations in one variable. For example solve:

(a) $3 - 2x = 3x + 8$ (b) $3(x - 2) = 3x - 6$ (c) $\frac{x}{6} - \frac{3}{4} = \frac{1}{3}$
(d) $3(2x - 1) = 4x + 2(x - 8)$ (e) $3x - 6(2x - 1) = 5x + 2$

4. Solve a literal equation for a given variable. For example solve

(a) $A = \frac{1}{2}(a + b)h$ for a (b) $y = 2x - 3$ for x

5. Solve a linear inequality and graph the solution set on a number line. For example solve for x and graph the solution set on a number line:

(a) $4 - 2x \leq 7$ (b) $x - 5 \geq x + 5$ (c) $2 - x < 3 - x$ (d) $2x - 3(x + 4) < 5$

6. Solve absolute value equations. For example solve:

(a) $|2x - 1| = 5$ (b) $|x - 1| + 2 = 8$ (c) $|x| + 5 = 2$ (d) $|x - 5| = |x + 2|$

7. Solve absolute value inequalities and graph the solution set on a number line. For example solve for x and graph the solution set on a number line:

(a) $|2x - 3| \leq 7$ (b) $2 + |x - 4| > 3$ (c) $|x| + 5 < 4$ (d) $|x - 2| + 4 > 1$

8. Find multiple solutions of a linear equation in 2 variables. For example find 3 solutions of $3x - 2y = 18$.

9. Graph a linear equation in two variables on a 2-dimensional coordinate system. For example sketch the graph:

(a) $2x - 5y = 20$ (b) $5y = 4$ (c) $y = 2x - 3$ (d) $x - 2 = 3$ (e) $3x - y = 0$

10. Graph a line given a point and the slope or given two points. For example graph the line with slope $-\frac{2}{3}$ through the point $(-1, 5)$.

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11. Find the slope of a line given its equation or given 2 points. For example find the slope of the line:

(a) $3x - 5y = 8$

(b) through the points $(-3, 2)$ and $(1, 4)$.

(c) $2y - 3 = 7$

(d) through the points $(-3, 4)$ and $(-3, -1)$

(e) $y - x = 5$

(f) with y -intercept 3 through the point $(2, -1)$

12. Find equations of lines given a point and the slope or given 2 points. For example find the equation of the line:

(a) with slope -2 through the point $(4, -1)$

(b) through the points $(-3, 5)$ and $(2, 1)$

13. Determine the equation of a line perpendicular or parallel to a given line through a given point. For example find the equation of the line through $(2, 0)$ and perpendicular to $3x - 2y = 5$.

14. Given the equations of two lines determine whether or not they are parallel or perpendicular. For example are the lines determined by the given equations parallel, perpendicular, or neither?

(a) $\begin{cases} 2x - 5y = 7 \\ 3x + 2y = 8 \end{cases}$

(b) $\begin{cases} 6x - 4y = 10 \\ 2y = 3x + 7 \end{cases}$

15. Solve a system of 2 linear equations in 2 variables. For example solve:

(a) $\begin{cases} 2x - 5y = 7 \\ 3x + 2y = 8 \end{cases}$

(b) $\begin{cases} 6x - 4y = 10 \\ 2y = 3x + 7 \end{cases}$

(c) $\begin{cases} 6a - 3b = 12 \\ -4a + 2b = -6 \end{cases}$

(d) $\begin{cases} 3x - y = 0 \\ x + y = 2 \end{cases}$

16. Solve word problems involving linear equations in 1 or 2 variables. For example a bag of dimes and quarters contains 35 coins. The total value is \$6.05. How many dimes are there?

17. Add, subtract, and multiply polynomials. For example perform the indicated operations.

(a) $(4x^3 - 5x + 6) + (3x^2 - 7x - 5)$

(b) $(6p^2 - 5p - 8) - (4p^2 - 6p + 9)$

(c) $(2x - 3y) - (3x + 5y)$

(d) $-3x^2(4x^2 - 7x + 1)$

(e) $-5m^3n(4m^2n^6)$

(f) $(3x - 2)(5x + 1)$

(g) $(4x - 1)(5x^2 - 7x + 3)$

(h) $5x - 4(3x - 2)$

18. Divide polynomials finding quotient and remainder. For example divide and find quotient and remainder.

(a) $\frac{2x^2 + 5x - 10}{x + 4}$

(b) $(10x^3 - 27x^2 + 28x - 10) \div (2x - 3)$

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19. Using only integer coefficients factor polynomials so that the greatest common factor is written as compactly as possible and so that other factors are factored as completely as possible. For example factor completely:

(a) $-15x^3y + 20x^4y^7z - 25x^3y^4$

(b) $m^3 + 1$

(c) $81x^4 - 16$

(d) $2x^3 + 3x^2 - 8x - 12$

(e) $x^2 - 11xy + 28y^2$

(f) $4x^3 - 32x^2y + 64xy^2$

20. Simplify square root expressions by extracting roots of perfect square factors. For example simplify

(a) $\sqrt{50}$

(b) $\sqrt{48}$

21. Solve quadratic equations in one variable. For example solve

(a) $3x^2 - 7x = 0$

(b) $6x^2 + 12 = 17x$

(c) $x^2 = 4x + 1$

(d) $(x - 2)^2 = 0$

(e) $x(8 - x) = 17$

22. Add, subtract, multiply, divide, and reduce rational expressions. For example perform the indicated operations and reduce.

(a) $\frac{6}{x} - 4x - 1$

(b) $\frac{8}{a} + 6a^2 - a$

(c) $\frac{2x^2 + 5x - 12}{x^2 - 4} \div \frac{2x^2 + 7x - 15}{x^2 - 25}$

(d) $\frac{x^2 - 8x + 12}{x^2 - 9xy + 18y^2} \div \frac{x^2 - 9y^2}{x^2 - 4}$

(e) $\frac{\frac{1}{x} + \frac{1}{y}}{\frac{1}{x} - \frac{1}{y}}$

(f) $\frac{x^2 - 4}{x^3 + 8}$

23. Solve rational equations reducible to linear or quadratic equations in one variable.

For example solve for x : $\frac{3}{x} + \frac{5}{x-1} = \frac{2}{x^2-x}$