



Math Workshop Elementary Algebra

Workshop Objective: Once a student successfully completes the Prealgebra Math Workshop, s/he will achieve a basic understanding the material taught in a MAT 052 course offered at Oakton. Students will be offered the skills and knowledge required of them to demonstrate competency on the Math Placement Test in any of the topics covered during the workshop.

Workshop Topics: Order of Operations with Real Numbers, Algebraic Expressions, Formulas, Exponents, Basic Operations with Polynomials, Factor Polynomials, Basic Operations with Rational Expressions, Solve and Graph Linear Equations/Inequalities in One Variable, Solve and Graph Linear Inequalities in Two Variables, Solve and Graph Systems of Linear Equations in Two Variables, Solve 2nd Degree Equations, Applications.

Workshop Overview: The workshop will identify and explain all of the various topics listed above. The topics covered during the workshop are found on the Oakton Math Placement Test. The supplementary exercises provided are a review of what a student would expect to learn in a MAT 052 course. **Any exercise sets labeled with an asterisk (*) are additional topics not necessarily found on the Math Placement Test.**

Once a student feels confident with all of these workshop topics, then another, more advanced Math Workshop is recommended. A student may re-take any workshop. Each student has an opportunity to re-take the Math Placement Test one time, if they are not satisfied with their test performance. Please feel free to discuss any of your concerns with your Math Workshop instructor. This workshop is not intended to be a substitute for taking/completing MAT 052 over a normal semester setting. Command in the topic material, and supplementary exercises, is not a guarantee that a student has qualified to place into a higher math course (above MAT 052). However, if a student does have a solid understanding of the topics covered, then that student should place into a higher math course (above MAT 052).

Order of Operations with Real Numbers

Simplify

1) $|2-7|-|2+7|$

2) $[-2^2+5^2]\div 2-5$

3) $2-4\ 5[3\div -1\times(-3)]$

4) $\frac{\left(\frac{2}{5}\right)}{\left(\frac{4}{15}\right)}$

5) $-0.03^2+0.56$

6) $-\frac{2}{3}+5\left(\frac{1}{5}+\frac{2}{3}\right)$

7) $\frac{2}{7}\left(-\frac{3}{7}\right)^2\div\frac{1}{7}$

8) $-1.56-4.97\div 2-4.56$

Algebraic Expressions

Evaluate. Given $x = -2$, $y = 3$, and $z = 5$.

1) x^3-4xy

2) $z+1^2+y$

3) $x-y\div -z$

4) $\frac{-x^3+y^3}{z+2}$

5) $xyz\div xyz$

Simplify

6) $2(x-5)+3(x+6)$

7) $-4-5(4-x)+5(2-x)$

8) $3^2+5(x-3)-4x+16$

9) $-3(x-6+3)-9x+3x$

10) $4x+5z$

Formulas

Solve for the following variables.

1) $C = 2\pi r$; r

2) $V = \frac{1}{3}hr^2$; h

3) $Ax + By = C$; y

4) $A = \frac{h}{2} (b_1 + b_2)$; b_1

5) $2xy + 4x = 6$; x

Exponents

Simplify

1) $-3x^3 - 4x^3$

2) $2x^2 - 4$

3) $-4x^4 - 5x^2 + 4x - 6$

4) $\frac{24x^4y^8}{8x^3y^4}$

5) $4xy^6z^6$

6) $567xyz^0$

Basic Operations with Polynomials

Simplify

1) $(x + y + z) + (x + y)$

2) $(x - y + z) - (z - x)$

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

4) $(x^3 - 3x^2 + 6x - 10) + (2x^3 + 5x^2 - 5x + 2)$

5) $(z + 4)(z - 4)$

6) $(x - 2)(x - 2)$

7) $(x - 1)^3$

8) $(4x + 2)(-2x - 3)$

9) $\left(\frac{6x^3 - 12x^2 + 3x}{3x} \right)$

10) $\left(\frac{16x^5 - 12x^4 + 4x^2}{-2x^2} \right)$

Factor Polynomials

Find the Greatest Common Factor (GCF).

1) $-4x + 20$

2) $12x^2 + 4x$

Factor completely.

3) $x^2 - 16$

4) $6x^3 + 48$

5) $27a^3 - 64b^3$

6) $4y^4 - 36$

7) $x^2 + 13x + 42$

8) $3x^2 - 24x + 48$

9) $100x^2 + 20x - 24$

10) $3x^2 + 17x - 6$

11) $x^2 + 6x - 40$

12) $x^8 - 256$

13) $x^2 + 4x + 6$

Factor by grouping.

14) $2x^2 - 10x + x - 5$

15) $4x^2 - 5x - 16x + 20$

Basic Operations with Rational Expressions

Simplify

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

2) $\frac{4x}{2-x} - \frac{3x}{x-2}$

3) $\frac{2}{x^2+10x+21} + \frac{-5}{x^2+5x-14}$

4) $\frac{x^2-25}{x^2+10x+25} \cdot \frac{x^2+12x+35}{x^2-2x-15}$

5) $\frac{x^2-16}{x^2+8x+16} \div \frac{x^2+9x+20}{x^2+6x+5}$

- 6) $\frac{x-4}{x^2-16} + \frac{x+2}{x-4}$
- 7) $\frac{3x}{x+6} \cdot \frac{x^2-36}{12x^2}$
- 8) $\frac{x^2-11x+30}{x^2-x-20} \cdot \frac{x^2+8x+16}{x^2+10x+25}$
- 9) $\frac{x}{x-6} + \frac{x+1}{x+2}$
- 10) $\frac{3x-1}{x^2+5x-6} - \frac{2x-7}{x^2+5x-6}$
- 11) $\frac{27}{x^2-81} + \frac{3}{2(x+9)}$
- 12) $\frac{5}{x-2} + \frac{7x}{x^2-4} - \frac{11}{x}$

Solve Linear Equations and Inequalities in One Variable

Solve

- 1) $3x = 33$
- 2) $-40 = -4x$
- 3) $x + \frac{x}{3} = 5$
- 4) $5x - 10 = 25$
- 5) $\frac{3x}{4} - \frac{1}{12} = \frac{5x}{2} + 2$
- 6) $10x - 4 = 4x + 5$
- 7) $2\frac{1}{3}x - 4 = 6x$
- 8) $\frac{45}{x} = \frac{12}{5}$
- 9) $\frac{8x}{3} = \frac{2x+1}{5}$
- 10) $\frac{9}{x^2-4} + \frac{2}{x+2} = \frac{-1}{x-2}$
- 11) $\frac{3}{x-3} = \frac{5}{x^2-9} - \frac{2}{x-3}$

*Solve and graph the solution. Identify the solution in interval notation.

12) $-4x \leq 16$

13) $-81 \geq 9y$

14) $2x - 14 > 6x - 8$

Roots and Radicals

Simplify. Round to the nearest thousandths place, if necessary.

1) $\sqrt{16}$

2) $\sqrt{25}$

3) $\sqrt{0}$

4) $\sqrt{1}$

5) $\sqrt{144}$

6) $\sqrt{2}$

7) $\sqrt{15}$

8) $\sqrt[3]{27}$

9) $\sqrt[4]{81}$

10) $\sqrt[3]{1000}$

11) $\sqrt[4]{256}$

12) $\sqrt{\frac{4}{9}}$

13) $\sqrt{\frac{1}{49}}$

14) $\sqrt{\frac{25}{36}}$

15) $\sqrt[3]{\frac{1}{8}}$

Solve and Graph Systems of Linear Equations/Inequalities in Two Variables

Write each equation in slope-intercept form. Find the slope and y-intercept of the following lines.

1) $-4x - 6y = 12$

2) $x = 4y - 7$

The given pairs of points are on the same line. Find the slope-intercept form of each line.

3) $(2, 3)$ & $(-1, -3)$

4) $(5, -6)$ & $(-1, -2)$

Solve.

5) $x + 3y = 6$

$4(x + 5y) = 2$

6) $-2x - 4y = 6$

$2x + 6y = 10$

7) $3x - 4y = 6$

$4y - 3x = 5$

8) $2x + 4 = y$

$6x - 3y = -12$

*Solve and graph.

9) $y > 5 - x$

10) $x \leq -2$

Solve 2nd Degree Equations

Solve

1) $x^2 - 4 = 0$

2) $x^2 + 5x + 6 = 0$

3) $3x^2 - 5x + 7 = 9$

4) $x^2 = -4$

5) $x^2 = 100$

6) $-2x^2 - 8x + 6 = 2x^2 - 4x + 6$

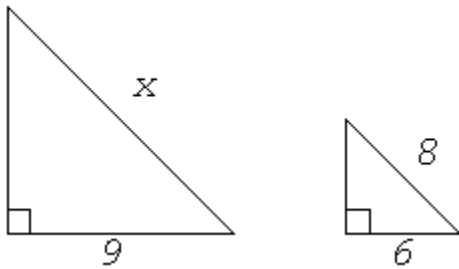
7) $(x - 4)(3x - 9) = 0$

Applications

- 1) The perimeter of a square is 36 units. Find its area.
- 2) The area of a square is 144 square units. Find the length of one of its sides.
- 3) The volume of a rectangular solid is given as $V = l \times w \times h$. If l , h , and w are tripled, how many times will the volume of the solid be than the original?
- 4) For all $x \neq 3$, find an equivalent expression to the following expression:

$$\frac{x^2 - 5x + 6}{x - 3}$$

- 5) Bob flies his airplane 495 miles with a tail wind of 25 miles per hour. Against the wind, he flies only 405 miles in the same amount of time. Find the rate of the plane in still air.
- 6) A number added to the product of 20 and the reciprocal of the number is 9. Find the number.
- 7) Given that the following two triangles are similar, find x .



- 8) Jerry can wash his car in 2 hours 15 minutes. His son Timmy can wash the same car in 1 hour 25 minutes. Find how long it takes if they work together.
- 9) The scale found on a map of Illinois shows $\frac{1}{4}$ inch is equivalent to 12 miles. How many inches is 30 miles equivalent to?
- 10) One side of a triangle is 4 times as long as the other side, and the third side is 15 inches long. If the perimeter is 40 inches, find the lengths of all three sides.
- 11) Twice the difference of a number and 6 is the same as five times the number decreased by 6. Find the number.
- 12) A rectangle has an area of 50 sq. ft. and its length is five feet longer than its width. Find the length and width of the rectangle.
- 13) The number a is 7 more than the product of 5 and b . Identify an equation that correctly relates the values of a and b .

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Elementary Algebra Math Workshop Solutions

Order of Operations with Real Numbers

Simplify

- 1) -4
- 2) -7
- 3) -178
- 4) $\frac{3}{2}$
- 5) 0.5609
- 6) $\frac{11}{3}$
- 7) $\frac{18}{49}$
- 8) $\frac{653}{256}$ or 2.551 (to the nearest thousandth)

Algebraic Expressions

Evaluate

- 1) 16
- 2) 39
- 3) 1
- 4) 5
- 5) 1
- 6) $5x + 8$
- 7) -14
- 8) $x + 10$
- 9) $9 - 9x$
- 10) $4x + 5z$

Formulas

- 1) $r = \frac{C}{2\pi}$
- 2) $h = \frac{3V}{r^2}$
- 3) $y = \frac{C - Ax}{B}$
- 4) $b_1 = \frac{2A}{h} - b_2$
- 5) $x = \frac{6}{2y + 4}$

Exponents

- 1) $-12x^6$
- 2) $16x^8$
- 3) $-20x^6 - 16x^5 + 24x^4$
- 4) $3xy^4$
- 5) $4096x^6 y^{36} z^6$
- 6) 1

Basic Operations with Polynomials

- 1) $2x + 2y + z$
- 2) $2x - y$
- 3) $-9x$
- 4) $3x^3 + 2x^2 + x - 8$
- 5) $z^2 - 16$
- 6) $x^2 - 4x + 4$
- 7) $x^3 - 3x^2 + 3x - 1$
- 8) $-8x^2 - 16x - 6$
- 9) $2x^2 - 4x + 1$
- 10) $-8x^3 + 6x^2 - 2$

Factor Polynomials

- 1) 4 or -4
- 2) $4x$ or $-4x$
- 3) $(x + 4)(x - 4)$
- 4) $6(x + 2)(x^2 - 2x + 4)$
- 5) $(3a - 4b)(9a^2 + 12ab + 16b^2)$
- 6) $4(y^2 - 3)(y^2 + 3)$
- 7) $(x + 7)(x + 6)$
- 8) $3(x - 4)(x + 4)$
- 9) $4(5x - 2)(5x + 3)$
- 10) $(3x - 1)(x + 6)$
- 11) $(x + 10)(x - 4)$
- 12) $(x - 2)(x + 2)(x^2 + 4)(x^2 + 16)$
- 13) Not factorable over the integers/Prime
- 14) $(x - 5)(2x + 1)$
- 15) $(x - 4)(4x - 5)$

Basic Operations with Rational Expressions

- 1) $\frac{x-5}{(x-1)(x-2)}$
- 2) $\frac{7x}{2-x}$ or $\frac{-7x}{x-2}$
- 3) $\frac{-3x-19}{(x+3)(x-2)(x+7)}$
- 4) $\frac{x+7}{x+3}$
- 5) $\frac{(x-4)(x+1)}{(x+4)(x+4)}$
- 6) $\frac{x^2+7x+4}{x^2-16}$
- 7) $\frac{x-6}{4x}$
- 8) $\frac{(x-6)(x+4)}{(x+5)^2}$
- 9) $\frac{2x^2-3x-6}{(x-6)(x+2)}$
- 10) $\frac{1}{x-1}$
- 11) $\frac{3}{2(y-9)}$
- 12) $\frac{x^2+10x+44}{x(x-2)(x+2)}$

Solve Linear Equations and Inequalities in One Variable

- 1) $x = 11$
- 2) $x = 10$
- 3) $x = 15/4$
- 4) $x = 15$
- 5) $x = -25/21$
- 6) $x = 3/2$
- 7) $x = -12/11$
- 8) $x = 75/4$
- 9) $x = 3/34$
- 10) $x = -7/3$
- 11) $x = -2$
- 12) $x \geq -4$
- 13) $-9 \geq y$
- 14) $x < -\frac{3}{2}$

Roots and Radicals

- | | |
|----------|-------------------|
| 1) 4 | 9) 3 |
| 2) 5 | 10) 10 |
| 3) 0 | 11) 4 |
| 4) 1 | 12) $\frac{2}{3}$ |
| 5) 12 | 13) $\frac{1}{7}$ |
| 6) 1.414 | 14) $\frac{5}{6}$ |
| 7) 3.873 | 15) $\frac{1}{2}$ |
| 8) 3 | |

Solve and Graph Systems of Linear Equations/Inequalities in Two Variables

1) $y = -\frac{2}{3}x - 2$, $m = -\frac{2}{3}$, y-int : $0, -2$

2) $y = \frac{1}{4}x + \frac{7}{4}$, $m = \frac{1}{4}$, y-int : $\left(0, \frac{7}{4}\right)$

3) $y = 2x - 1$

4) $y = -\frac{2}{3}x - \frac{8}{3}$

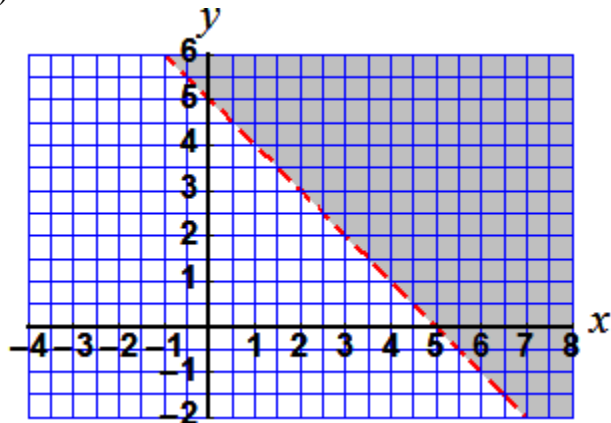
5) $\left(\frac{57}{4}, -\frac{11}{4}\right)$

6) $-19,8$

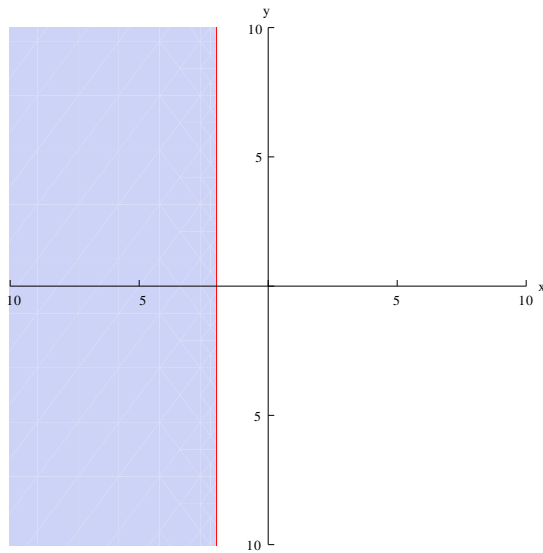
7) No solution

8) Infinite number of solutions

9)



10)



Solve 2nd Degree Equations

1) $x = \pm 2$

2) $x = -3$ or $x = -2$

3) $x = -\frac{1}{3}$ or $x = 2$

4) No solution

5) $x = \pm 10$

6) $x = 0$ or $x = -1$

7) $x = 4$ or $x = 3$

Applications

1) 81 units²

2) 12 units

3) 27 times larger

- 4) $x - 2$
- 5) 250 mph
- 6) $x = 5$ or $x = 4$
- 7) $x = 12$
- 8) $t = 52$ minutes
- 9) .625 in or $\frac{5}{8}$ in
- 10) 15 in, 20 in, 5 in
- 11) -14
- 12) width = 5 ft, length = 10 ft
- 13) $a = 5b + 7$