

# MATHEMATICS COMPETENCY TEST

## SAMPLE TEST

*Applies to new students entering*

*Fall 2005*

- A scientific, non-graphing calculator is allowed for this test.
- The following formulas may be used on this test:

Area of a triangle:  $A = \frac{1}{2}bh$

Area of a rectangle:  $A = LW$

Perimeter of a rectangle:  $P = 2L + 2W$

Area of a circle:  $A = \pi r^2$

Circumference of a circle:  $C = 2\pi r$

Distance traveled:  $D = RT$

Pythagorean theorem:  $a^2 + b^2 = c^2$

$a$  and  $b$  are legs of a right triangle;  $c$  is the hypotenuse

Quadratic formula:  $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Slope of a line through the points  $(x_1, y_1)$  and  $(x_2, y_2)$ :  $m = \frac{y_2 - y_1}{x_2 - x_1}$

Standard form of a line:  $ax + by = c$

Slope-intercept form of a line:  $y = mx + b$

Point-slope form of a line:  $y - y_1 = m(x - x_1)$

- Answers may be found on the last page of this test.

**MATHEMATICS COMPETENCY EXAM  
SAMPLE TEST**

1. Evaluate:  $|\square 7| \square 3 \cdot 8 + 20 \div 2 =$

- a.** 42                      **b.** -14                      **c.** 21  
**d.** -7                        **e.** 26

Order of operations

2.  $\frac{\frac{5}{8}}{\frac{21}{40}} =$       **a.**  $\frac{21}{25}$               **b.**  $\frac{21}{64}$               **c.** 21  
**d.**  $\frac{1}{21}$                 **e.**  $\frac{25}{21}$

Simplify complex fraction

3.  $\square 2^4 =$       **a.** -16              **b.** 16              **c.** 8              **d.** -8  
**e.** none of these

Use exponent rules;  
identify base, exponent,  
coefficient of exponential  
expression

4.  $4x^0$  is:      **a.** undefined      **b.** 0              **c.** 4              **d.** 1  
**e.** none of these

Use exponent rules

5.  $16^{1/2} =$       **a.** 4              **b.**  $\frac{1}{4}$               **c.** 8              **d.**  $\frac{1}{8}$               **e.**  $\frac{1}{32}$

Use exponent rules

6.  $\sqrt[3]{x^4}$  is the same as:

- a.**  $x^{3/4}$       **b.**  $x^{4/3}$       **c.**  $\frac{4x}{3}$       **d.**  $3x^4$       **e.**  $\frac{x^4}{3}$

Use exponent rules

7.  $A = kB$  where  $k > 0$ . If  $B$  increases,  $A$  will:

- a.** increase      **b.** decrease      **c.** stay the same  
**d.** can't tell without knowing the values of  $A$  and  $B$

Direct and inverse  
variation; ratio

8. Simplify and write your answer without negative exponents:

Use exponent rules

$$\frac{3x^2 y^2}{y^2} = ?$$

- a.  $\frac{6y}{x^4}$       b.  $\frac{9x^0}{y^2}$       c.  $\frac{6x^4}{y^2}$       d.  $\frac{y^2}{9x^4}$       e. none of these

9. Subtract:  $(5x^2 - 2xy + 3y^2) - (4x^2 + xy - 3y^2) =$

Operations on polynomials

- a.  $9x^2 - xy$       b.  $9x^2 - xy + 6y^2$       c.  $9x^2 - 3xy$   
d.  $9x^2 - 3xy + 6y^2$       e. none of these

10. Multiply:  $(3x + 5)(x - 4) =$

Operations on polynomials

- a.  $3x^2 - 20$       b.  $3x^2 + 7x - 20$       c.  $3x^2 - 7x - 20$   
d.  $3x^2 - 7x + 20$       e. none of these

11. Expand:  $(2x - 5)^2 =$

Operations on polynomials

- a.  $4x - 10$       b.  $4x^2 - 25$       c.  $4x^2 - 10x + 25$   
d.  $4x^2 + 25$       e.  $4x^2 - 20x + 25$

12. Multiply  $3x^2 y(4xy - 2y^3 + 5x^4 y^2)$

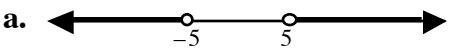

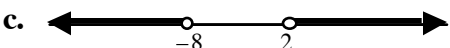
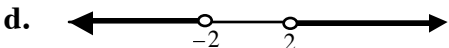

Operations on polynomials

- a.  $12x^3 y^2 - 2y^3 + 5x^4 y^2$       b.  $7x^3 y^2 - x^2 y^4 + 2x^6 y^3$   
c.  $12x^3 y^2 - 6x^2 y^4 + 15x^6 y^3$       d.  $12x^2 y - 6x^2 y^3 + 15x^6 y^2$   
e. none of these

13. Divide:  $\frac{15m^3 n^4 + 3mn^2 - 12mn}{3mn^2} =$

Operations on polynomials

- a.  $12m^3 n^2 + 9n$       b.  $5m^2 n^2 + 1mn - 4mn^2$       c.  $5m^3 n^2 + 4n$   
d.  $5m^2 n^2 + 1 + \frac{4}{n}$       e. none of these

14. The greatest common factor of the polynomial  $12a^2b^2 + 18ab^3 - 24a^3b^2$  is:  
 Determine the GCF of a polynomial; factor monomial from a polynomial  
 a.  $12ab$    b.  $6a^2b^2$    c.  $24a^3b^3$    d.  $6ab$    e. none of these
15. One factor of  $6x^2 - 11x - 10$  is:  
 Factor trinomial  
 a.  $3x + 10$    b.  $3x - 2$    c.  $6x + 5$    d.  $2x - 5$    e. can't be factored
16. When the formula:  $Ax + By = C$  is solved for B, the result is:  
 Evaluate a formula or solve for given variable  
 a.  $\frac{C - Ax}{y}$    b.  $\frac{C - By}{Ax}$    c.  $\frac{C - y}{Ax}$    d.  $\frac{C}{Ax + y}$    e. none of these
17. Solve for x:  $\frac{3}{4}x + 2 = \frac{x}{6}$   
 Solve a linear equation involving fractional or integer coefficients  
 a.  $\frac{12}{7}$    b.  $\frac{2}{11}$    c.  $\frac{2}{7}$    d.  $\frac{24}{11}$    e. none of these
18. The solution for the inequality  $-6 \leq 10 - 2x < 14$  is:  
 Solve a compound inequality involving fractional or integer coefficients  
 a.  $x \geq -2$    b.  $-8 \leq x < 2$    c.  $-2 < x \leq 8$   
 d.  $-2 < x \leq 12$    e. none of these
19. The number line solution for the inequality  $|x + 3| > 5$  is:  
 Solve or interpret absolute value inequality; read answer on number line  
 a.    b.   
 c.    d.   
 e. 
20. When the system of equations  $\begin{cases} 2x + y = 6 \\ 3x - 2y = 16 \end{cases}$  is solved, the value of x is:  
 Solve a 2x2 system of linear equations  
 a. 4   b. 2   c. -2   d. 3   e. -3

21. The solutions of the equation  $x^2 = 6x + 16$  would add up to: Solve a quadratic equation  
**a.** 8    **b.** 6    **c.** -4    **d.** 4    **e.** 0
22. The solution set for the quadratic equation  $x^2 - 6x + 10 = 0$  would consist of: Solve a quadratic equation  
**a.** two real numbers                      **b.** one real number  
**c.** two imaginary numbers                **d.** one imaginary number    **e.** none of these
23. In a triangle, the sum of the angles is  $180^\circ$ . If one angle is  $25^\circ$  greater than the smallest angle, and the other angle is  $5^\circ$  less than twice the smallest angle, find the measure of the smallest angle. Application problem using linear or quadratic equations  
**a.**  $40^\circ$     **b.**  $35^\circ$     **c.**  $52^\circ$     **d.**  $29^\circ$     **e.** not enough information is given
- 24a. A salesperson earns a weekly base salary of \$210. She also earns a 6% commission on her total dollar amount of sales for the week. What is the dollar amount of sales in a week where she made total earnings of \$450? Application problem using linear or quadratic equations involving percent  
**a.** \$5,670    **b.** \$2,370    **c.** \$4,000    **d.** \$11,000  
**e.** none of these

**OR**

- 24b. Kerri can buy a season pass to the high school girls soccer games for \$20. Without the pass, each game costs \$2.25. How many games would Kerri have to attend to make the season pass a better deal? Application problem using linear or quadratic equations involving comparisons  
**a.** 6    **b.** 7    **c.** 8    **d.** 9    **e.** 10
25. The length of a rectangle is 8 meters more than twice its width. If the rectangle has a perimeter of 94 meters, what is the length of the rectangle? Application problem involving circumference, perimeter, or area, using linear or quadratic equations  
**a.** 13 meters    **b.** 27 meters    **c.** 42 meters  
**d.** 34 meters    **e.** none of these
26. Simplify completely:  $\frac{4x^2 - 9}{2x^2 + x - 3} = ?$  Rational expressions  
**a.**  $\frac{x - 3}{x + 1}$     **b.**  $\frac{5}{x}$     **c.**  $\frac{2x - 3}{x - 1}$     **d.**  $\frac{2x - 9}{x - 3}$   
**e.** none of these

27. Add the fractions and simplify:  $\frac{5m}{6n^3} + \frac{7}{12m^2n} = ?$  Operations with rational expressions

- a.  $\frac{10m^3 + 7n^2}{12m^2n^3}$     b.  $\frac{5m^3 + 7n^3}{12m^2n^4}$     c.  $\frac{5m + 7}{72m^2n^4}$     d.  $\frac{5m^2 + 14n}{6mn}$   
 e. none of these

28. Divide and simplify:  $\frac{x}{x+2} \div \frac{3x^2}{x^2 - 4} = ?$  Operations with rational expressions

- a.  $\frac{3x^3}{x - 2}$     b.  $\frac{3}{(x+2)^2}$     c.  $\frac{x - 2}{3x}$     d.  $\frac{3}{-8}$     e. none of these

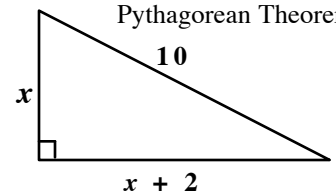
29. For the similar figures shown, an equation that will determine the value of  $x$  is: Application problem involving proportion



- a.  $x^2 + x = 6x + 24$     b.  $x^2 + 4x = 6x + 6$     c.  $2x + 4 = x + 6$   
 d.  $x^2 + 5x + 4 = 6x$     e. none of these

30. An equation that will determine the value of  $x$  in the given right triangle is: Application of Pythagorean Theorem

- a.  $x + (x + 2) + 10 = 0$     b.  $2x^2 + 4x - 96 = 0$   
 c.  $x^2 + 2x = 10$     d.  $2x^2 - 96 = 0$   
 e. none of these



31. Completely simplify the radical  $\sqrt{60x^2y^5}$  Roots and radicals

- a.  $30xy^{2.5}$     b.  $4xy\sqrt{15xy}$     c.  $20x^2y^2\sqrt{3y}$     d.  $2xy^2\sqrt{15y}$   
 e. none of these

32. The solution the radical equation  $\sqrt{x^2 + 3} = x + 5$  is: Roots and radicals
- a. less than zero      b. between 0 and 10      c. greater than 10  
 d. there is no solution      e. none of these

- 33a. Two trains leave a station at the same time, traveling in opposite directions. Applications of  
linear equations:  
distance, rate, time  
 The rate of the first train is 14 *mph* faster than that of the second train.  
 If they are 730 miles apart in 5 hours, find the rate of the second train.
- a. 110 *mph*      b. 80 *mph*      c. 71.6 *mph*  
 d. 66 *mph*      e. none of these

**OR**

- 33b. Find an equation (or pair of equations) representing the information in the Applications of  
linear equations:  
mixtures  
 following word problem:

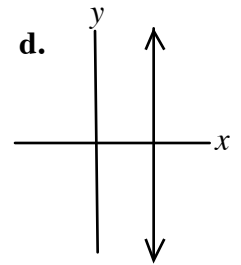
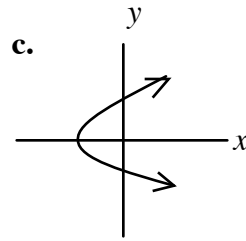
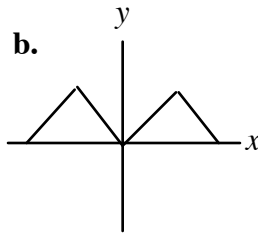
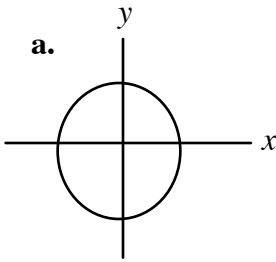
A food stand sells hot dogs for \$2.00 and beef tacos for \$2.50 each. If the sales for the day total \$635, and 278 items were sold, how many hot dogs were sold?

- a.  $\begin{cases} x + y = 635 \\ 2x + 2.5y = 278 \end{cases}$       b.  $\begin{cases} x + y = 278 \\ 2x + 2.5y = 635 \end{cases}$       c.  $2x + (278 - x) = 2.5x$   
 d.  $2x + 2.5(635 - x) = 278$       e. none of these
34. The slope of the line between the points (2, -1) and (4, 5) is: Evaluate slope of a line  
 a. 3      b. 2      c. -3      d. -2      e. 2/3
35. For the line  $3x - 2y = 12$ , the  $x$ -intercept is: Find intercepts of a line  
 a. (0, -6)      b. (3, 0)      c. (2, 0)      d. (0, -2)      e. none of these
36. Find the equation of a line through the point (3, 2) and parallel to Find equation of a line  
 the line  $y = 6 - 3x$ .
- a.  $3x + y = 9$       b.  $3x + y = 11$       c.  $y = 3x - 7$       d.  $y = 6x - 16$   
 e. none of these

37. If  $f(x) = x^2 + 4x - 3$  then  $f(-5) = ?$  Understand function notation;  
identify function value
- a. 2      b. -8      c. 42      d. -48      e. none of these

38. Which of the following graphs shows a function  $f(x)$ ?

Recognize graph of a function

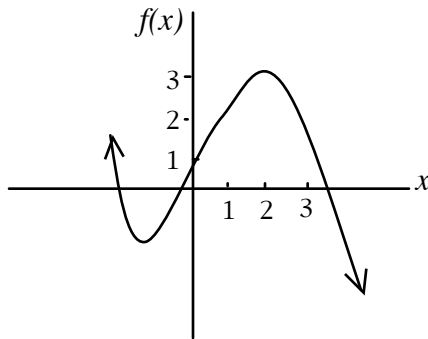


**e.** none of these is a function

39. In the graph of function  $y = f(x)$  shown below,  $f(2)$  is:

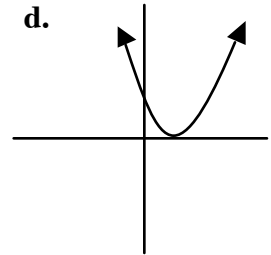
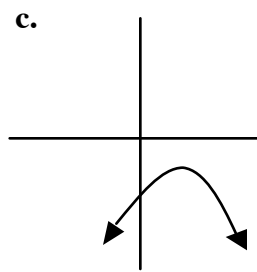
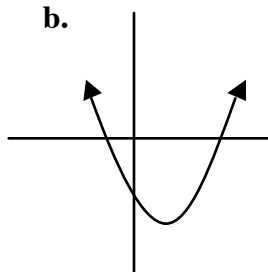
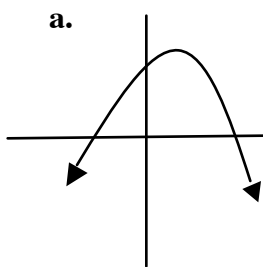
Identify function value from a graph

**a.** not defined    **b.** 0    **c.** 1    **d.** 2    **e.** 3



40. The graph that shows a quadratic function with *two real numbers* as roots and a *negative* coefficient of the  $x^2$  term is:

Analyze function properties for linear and quadratic functions



**e.** none of these



## ANSWER KEY--SAMPLE TEST

- |       |                |
|-------|----------------|
| 1. D  | 21. B          |
| 2. E  | 22. C          |
| 3. A  | 23. A          |
| 4. C  | 24a. C; 24b. D |
| 5. A  | 25. D          |
| 6. B  | 26. C          |
| 7. A  | 27. A          |
| 8. D  | 28. C          |
| 9. D  | 29. A          |
| 10. C | 30. B          |
| 11. E | 31. D          |
| 12. C | 32. A          |
| 13. D | 33a. D; 33b. B |
| 14. E | 34. A          |
| 15. D | 35. E          |
| 16. A | 36. B          |
| 17. D | 37. D          |
| 18. C | 38. B          |
| 19. C | 39. E          |
| 20. A | 40. A          |