MATHEMATICS COMPETENCY TEST

SAMPLE TEST

2005

- A scientific, <u>non-graphing</u> 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: $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

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

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: $|-7| - 3 \cdot 8 + 20 \div 2 =$

    a. 42   **b.** −14   **c.** 21   Order of operations

    d. −7   **e.** 26

2. $\dfrac{\frac{5}{8}}{\frac{21}{40}} =$ **a.** $\dfrac{21}{25}$ **b.** $\dfrac{21}{64}$ **c.** 21   Simplify complex fraction

               d. $\dfrac{1}{21}$ **e.** $\dfrac{25}{21}$

3. $-2^4 =$ **a.** −16   **b.** 16   **c.** 8   **d.** −8   Use exponent rules; identify base, exponent, coefficient of exponential expression

         e. none of these

4. $4x^0$ is: **a.** undefined   **b.** 0   **c.** 4   **d.** 1   Use exponent rules

         e. none of these

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

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

     a. $x^{3/4}$ **b.** $x^{4/3}$ **c.** $\dfrac{4x}{3}$ **d.** $3x^4$ **e.** $\dfrac{x^4}{3}$ Use exponent rules

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

     a. increase   **b.** decrease   **c.** stay the same   Direct and inverse

     d. can't tell without knowing the values of A and B variation; ratio

8. Simplify and write your answer without negative exponents: Use exponent rules

$$\left(\frac{-3x^2}{y}\right)^{-2} = ?$$

a. $\dfrac{6y}{x^4}$ b. $\dfrac{9x^0}{y^2}$ c. $\dfrac{6x^4}{y^2}$ d. $\dfrac{y^2}{9x^4}$ 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. $4x^2 - 20x + 25$
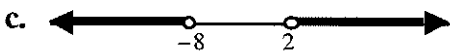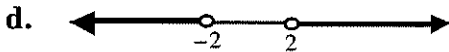
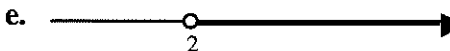12. Multiply $3x^2 y(4xy - 2y^3 - 5x^4 y^2)$ Operations on polynomials
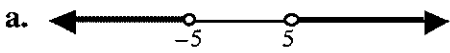
a. $12x^3 y^2 - 2y^3 - 5x^4 y^2$ b. $7x^3 y^2 - x^2 y^4 - 2x^6 y^3$

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: $\dfrac{15m^3 n^4 + 3mn^2 - 12mn}{3mn^2} =$ Operations on polynomials

a. $12m^3 n^2 - 9n$ b. $5m^2 n^2 + 1mn - 4mn^2$ c. $5m^3 n^2 - 4n$

d. $5m^2 n^2 + 1 - \dfrac{4}{n}$ e. none of these

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14. The greatest common factor of the polynomial $12a^2b^2 + 18ab^3 - 24a^3b^2$
    is:

    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:

    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:

    a. $\dfrac{C - Ax}{y}$ **b.** $\dfrac{C - By}{Ax}$ **c.** $\dfrac{C - y}{Ax}$ **d.** $\dfrac{C}{Ax + y}$ **e.** none of these

17. Solve for x: $\frac{-3}{4}x + 2 = \frac{x}{6}$

    a. $\dfrac{-12}{7}$ **b.** $\dfrac{2}{11}$ **c.** $\dfrac{-2}{7}$ **d.** $\dfrac{24}{11}$ **e.** none of these

18. The solution for the inequality $-6 \le 10 - 2x < 14$ is:

    a. $x \ge -2$ **b.** $-8 \le x < 2$ **c.** $-2 < x \le 8$

    d. $-2 < x \le 12$ **e.** none of these

19. The number line solution for the inequality $|x + 3| > 5$ is:

    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:

    a. 4   **b.** 2   **c.** -2   **d.** 3   **e.** -3

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21. The solutions of the equation $x^2 = 6x + 16$ **would add up to**:

        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:

        a. two real numbers   **b.** one real number
        c. two imaginary numbers   **d.** one imaginary number **e.** none of these

Solve a quadratic equation

23. In a triangle, the sum of the angles is 180°. If one angle is 25° greater than the smallest angle, and the other angle is 5° less than twice the smallest angle, find the measure of the smallest angle.

Application problem using linear or quadratic equations

        a. 40°   **b.** 35°   **c.** 52°   **d.** 29°   **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: $\dfrac{4x^2 - 9}{2x^2 + x - 3} = ?$

Rational expressions

        a. $\dfrac{x-3}{x+1}$ **b.** $\dfrac{5}{x}$ **c.** $\dfrac{2x-3}{x-1}$ **d.** $\dfrac{2x-9}{x-3}$

        e. none of these

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

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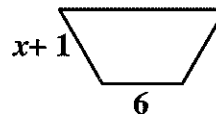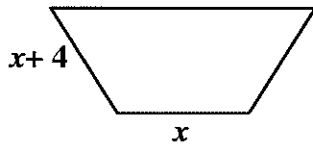
    e. none of these

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

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

29. For the similar figures shown, an equation that will   Application problem
determine the value of x is: 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
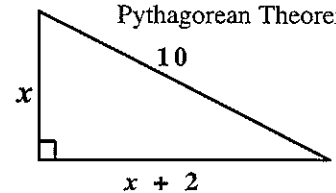
31. Completely simplify the radical $\sqrt{60x^2 y^5}$ Roots and radicals

    a. $30xy^{2.5}$ **b.** $4xy\sqrt{15xy}$ **c.** $20x^2 y^2 \sqrt{3y}$ **d.** $2xy^2 \sqrt{15y}$

    e. none of these

32. The solution the radical equation $\sqrt{x^2 + 3} = x + 5$ is:

    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.
      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
      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:
    a. 3   **b.** 2   **c.** -3   **d.** -2   **e.** 2/3

35. For the line $3x - 2y = 12$, the x-intercept is:

    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
    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 $f(-5) = ?$

    a. 2   **b.** -8   **c.** 42   **d.** -48   **e.** none of these

38. Which of the following graphs shows a function f(x)?
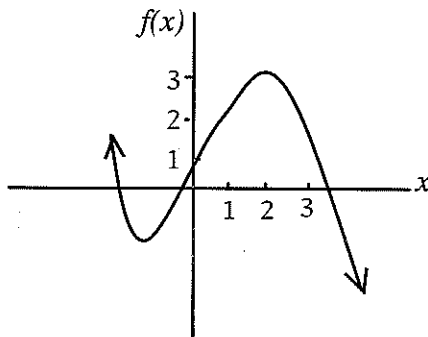
a.   **b.**   **c.**   **d.**
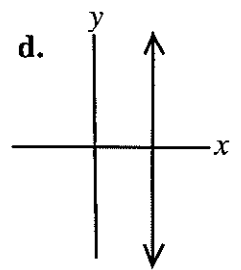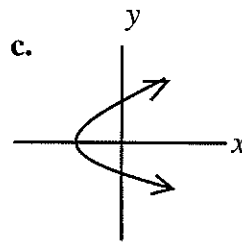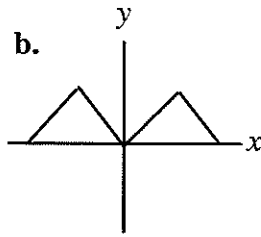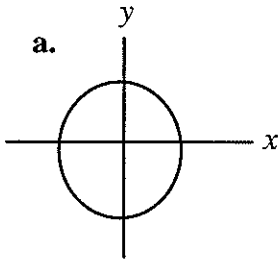
e. none of these is a function

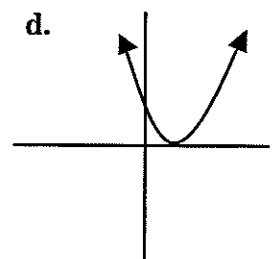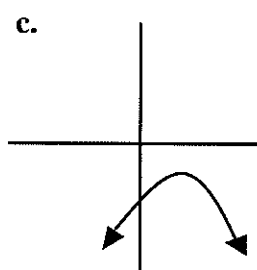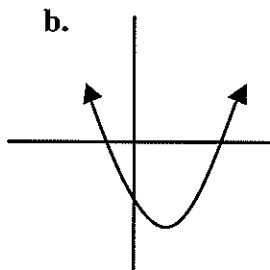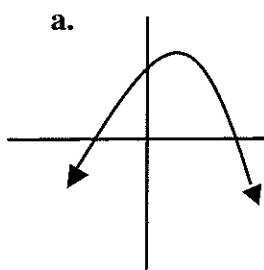39. In the graph of function $y = f(x)$ shown below, $f(2)$ is: Identify function value from a graph

    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

a.   **b.**   **c.**   **d.**

e. none of these

8

ANSWER KEY--SAMPLE TEST

1. D
2. E
3. A
4. C
5. A
6. B
7. A
8. D
9. D
10. C
11. E
12. C
13. D
14. E
15. D
16. A
17. D
18. C
19. C
20. A

21. B
22. C
23. A
24a. C; 24b. D
25. D
26. C
27. A
28. C
29. A
30. B
31. D
32. A
33a. D; 33b. B
34. A
35. E
36. B
37. D
38. B
39. E
40. A