W Carolina Univ HS Math Samples

1. Multiply: $(3\sqrt{12})(2\sqrt{8})$

   (A) $6\sqrt{20}$ (B) $5\sqrt{20}$

   (C) $24\sqrt{5}$ (D) $24\sqrt{6}$

   (E) none of the above

2. If $ab = \frac{3}{2}$ and $ac = \frac{5}{2}$, then $\frac{b}{c}$ is:

   (A) $\frac{15}{4}$ (B) $\frac{2}{3}$ (C) $\frac{3}{5}$

   (D) $\frac{1}{2}$ (E) $\frac{4}{15}$

3. Subtract: $\dfrac{a+3}{2a^2+5a-12} - \dfrac{a-1}{2a^2+7a-4}$

   The numerator of the simplified answer is:

   (A) $10a - 6$ (B) $4a^2$

   (C) $6a - 6$ (D) $4a^2 + 6a - 6$

   (E) $4a^2 + 6a + 6$

4. $\left(a^{\frac{5}{3}} b^{\frac{-1}{2}} c^{\frac{2}{5}}\right)^3$ divided by $\left(a^{\frac{-1}{2}} b^{\frac{1}{3}} c^{\frac{3}{5}}\right)^{-2}$ is:

   (A) $\dfrac{a^4}{b^{\frac{5}{6}}}$ (B) $\dfrac{a^4 c^{\frac{12}{5}}}{b^{\frac{5}{6}}}$ (C) $\dfrac{a^4}{b^{\frac{13}{6}}}$

   (D) $\dfrac{a^4 c^{\frac{12}{5}}}{b^{\frac{13}{6}}}$ (E) $\dfrac{a^{\frac{65}{6}}}{b^{\frac{25}{6}} c}$

5. The expression $(3a - b)^2 - (2a + b)^2$ is equivalent to:

   (A) $(a - 2b)5a$

   (B) $5a^2 - 10ab$

   (C) $[(3a - b) - (2a + b)]^2$

   (D) $5a^2 - 2ab + 2b^2$

   (E) $(a)(5a - 2b)$

6. What is the solution set of $\left|\dfrac{5+2x}{2-x}\right| \geq 1$?

   (A) $\{x \mid x \leq -7 \text{ or } x \geq -1\}$

   (B) $\{x \mid x \leq -7 \text{ or } x > 2\}$

   (C) $\{x \mid -7 \leq x \leq -1\}$

   (D) $\{x \mid x \leq -7 \text{ or } -1 \leq x < 2 \text{ or } x > 2\}$

   (E) $\{x \mid -1 \leq x < 2\}$

7. One factor of $25x^4 - 11x^2y^2 + y^4$ is:

   (A) $5x^2 - y^2$

   (B) $5x^2 + y^2$

   (C) $5x^2 - y^2 + xy$

   (D) $5x^2 + y^2 + xy$

   (E) none of the above

8. If -3 is one root of $2x^2 + bx - 3 = 0$, the value of b is:

   (A) $\frac{1}{2}$ (B) 5 (C) 3 (D) 1

   (E) none of the above

9. Let $A = 0.4x^2 + 10x + 5$ and $B = 0.5x^2 + 2x + 101$. For what value of x is $A - B$ a maximum?

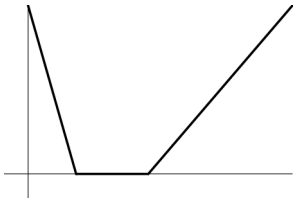
(A) $x = 40$. (B) $x = -40$.

(C) $x = -12.5$. (D) $x = 12.5$.

(E) $x = -2$.

10. You walk to the store quickly, stay there for a minute and walk back home more slowly. Which graph best represents your distance from the store as a function of time?

(A)



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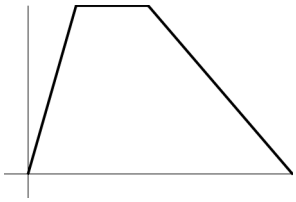

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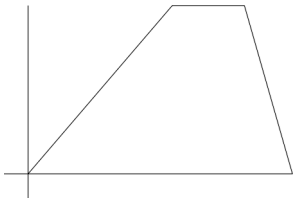

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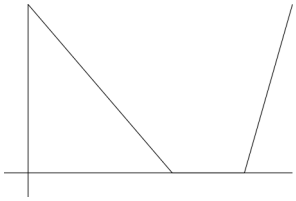

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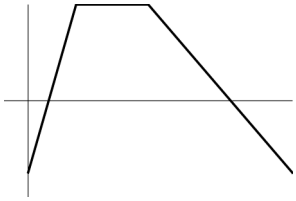


11. Find the domain of $f(x) = \sqrt{x^2 + 2x - 15}$

(A) $(-\infty, 5)$

(B) $(-5, 3)$

(C) $(-\infty, -5] \cup [3, \infty)$

(D) $(-\infty, \infty)$

(E) $[3, \infty >$

12. The solution set of $\dfrac{1}{x-1} \leq \dfrac{1}{x+1}$ is:

(A) $(-1, 1)$

(B) $(-\infty, -1) \cup (1, \infty)$

(C) Empty set

(D) $(-\infty, \infty)$

(E) $\left[-\frac{1}{2}, \frac{1}{2}\right]$

13. Jim has \$45 in quarters, half-dollars and dollars. If the number of half dollars is 10 less than the number of dollars and the number of quarters is twice the number of dollars, how many quarters are there?

(A) 25 (B) 50 (C) 40 (D) 15

(E) none of the above

14. The solution, (x, y, z), to the system:
$$\begin{cases} x + y + z = 2 \\ 2x + 3y - z = 3 \\ 3x + 5y + z = 8 \end{cases}$$

(A) $(3, 0, -1)$ (B) $(1, 2, -1)$

(C) $(3, -1, 0)$ (D) $(3, -1, 4)$

(E) $(-1, 2, 1)$

15. The line $mx - ny = 1$ passes through the two points $(2, -3)$ and $(-4, -1)$. The values of m and n are:

(A) $m = \frac{3}{7}$, $n = -\frac{1}{7}$ (B) $m = \frac{1}{7}$, $n = \frac{3}{7}$

(C) $m = \frac{1}{7}$, $n = -\frac{3}{7}$ (D) $m = -1$, $n = 3$

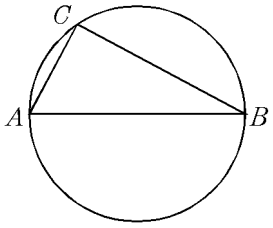
(E) $m = -\frac{1}{7}$, $n = \frac{3}{7}$

16. Solve for y: $\frac{1}{x} = \frac{1}{y} + \frac{1}{z}$

(A) $\frac{xz}{z - x}$ (B) $x - z$ (C) $\frac{xz}{z + x}$

(D) $\frac{1}{x - z}$ (E) $x + \frac{xy}{z}$

17. If AB is a diameter of the circle and $m\angle BAC = 72^\circ$, then the measure of the minor arc AC is:



(A) 36°

(B) 72°

(C) 90°

(D) 18°

(E) 9°

18. Find the area of the triangle with vertices $(-2, 1)$, $(2, 4)$, and $(3, 1)$.

(A) 7.5 (B) $\frac{10 + \sqrt{10}}{2}$

(C) 6.4 (D) $10 + \sqrt{10}$

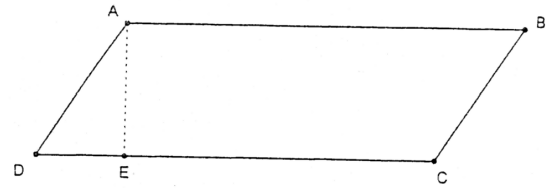
(E) 12.5

19. If the line segment joining the midpoints of two sides of an equilateral triangle measures 12, find the measure of the perimeter of the triangle.

(A) 24 (B) 36 (C) 48

(D) 72 (E) 144

20. Find the area of the parallelogram $ABCD$ shown below if the measure of segments $\overline{AB}$, $\overline{BC}$, and $\overline{DE}$ are 6 units, 2 units, and 1 unit respectively and $\angle AED$ is a right angle.



(A) 5 square units

(B) 12 square units

(C) $5\sqrt{3}$ square units

(D) $6\sqrt{3}$ square units

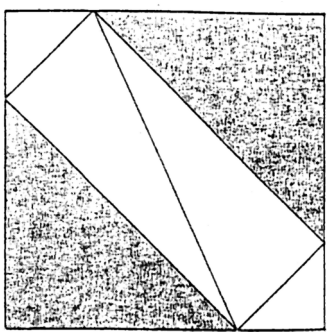
(E) 16 square units

21. Triangle ABC is inscribed in circle O. $m\overset{\frown}{BC} : m\overset{\frown}{CA} : m\overset{\frown}{AB} = 2 : 3 : 5$. Then the number of degrees contained in the acute angle formed by side BC and the tangent to the circle at B is:

(A) 72° (B) 108° (C) 36°

(D) 18° (E) 54°

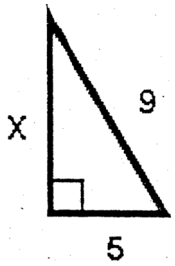
22. A rectangle is inscribed in a square such that there is an isosceles triangle in each corner. The combined area of the four triangles is 200. Find the length of the rectangle's diagonal.



(A) 20 (B) 25 (C) 30

(D) 35 (E) 40

23. Find the value of X on the diagram below.



(A) $14\sqrt{2}$. (B) $2\sqrt{14}$. (C) $\sqrt{106}$.

(D) $\sqrt{28}$. (E) $5\sqrt{3}$.

24. If each dimension of a rectangle were increased by 5 feet, the area would be increased by 95 square feet, and one dimension would become twice the other. Find the original dimensions:

(A) $\frac{285}{14}$ and $\frac{14}{3}$ (B) 3 and 11

(C) $\frac{95}{3}$ and $\frac{190}{3}$ (D) -3 and -11

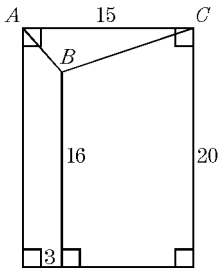
(E) 9 and 7

25. The areas of a square and rectangle are the same. What is the measurement of the side of the square if the width of the rectangle is 3 cm and its length is 60 cm longer that the side of the square?

(A) 12 cm (B) 15 cm (C) 18 cm

(D) 10 cm (E) 6 cm

26. What is the sum of the length of $\overline{BA}$ and the length of $\overline{BC}$?



(A) $5 + \sqrt{15}$

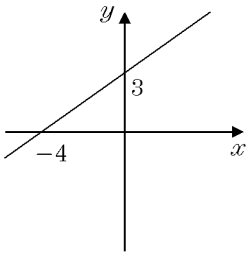
(B) $5 + 16\sqrt{10}$

(C) $\sqrt{165}$

(D) $5 + 4\sqrt{10}$

(E) $4\sqrt{10}$

27. Which of the following is the equation for the given graph?



(A) $y = -\frac{3}{x}4 + 3$

(B) $y = \frac{4x}{3} - 4$

(C) $y = \frac{3x}{4} + 3$

(D) $y = -\frac{4x}{3} + 3$

(E) $y = \frac{3x}{4} - 4$

28. If the line $y = mx$ passes through the center of the circle $4x^2 + 4y^2 - 4x + 12y - 6 = 0$, then m equals:

(A) $-\frac{1}{3}$ (B) -3 (C) $\sqrt{2}$

(D) $\frac{1}{3}$ (E) 3

29. The number of points of intersection of the graphs of the equations $y = x^2 - 2$ and $x = y^2 + 8y + 12$ is:

(A) 0. (B) 1. (C) 2. (D) 3. (E) 4.

30. Suppose that ABC is a triangle and $\overline{DE}$ is a line segment. If D lies on $\overline{AC}$, B is the midpoint of $\overline{DE}$, which of the following statements is always true?

(A) $\angle BAD$ is congruent to $\angle BDC$

(B) $\angle BAD$ is congruent to $\angle CBD$

(C) $\angle BAD$ is congruent to $\angle CBE$

(D) $\angle BAD$ is less than $\angle CBE$

(E) $\angle BAD$ is greater than $\angle CBE$

31. Given $RQ = US$ and $\angle RUX \cong \angle S$, which of the following would imply that $\triangle RUX \cong \triangle QSY$?

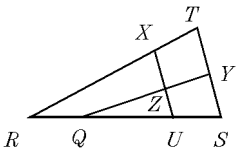
(A) $\angle T \cong \angle XZY$

(B) $RX = QY$

(C) $XZ = YZ$

(D) $\overline{QY} \perp \overline{XU}$

(E) $QZ = UZ$



32. The formula for the volume of a circular cone is $V = \frac{1}{3}\pi r^2 h$. The height of a circular cone is twice its radius r. The radius of the cone expressed as a function of its volume, V, is:

(A) $\sqrt[3]{\frac{V}{6\pi}}$ (B) $\sqrt[3]{\frac{3V}{2\pi}}$ (C) $\sqrt[3]{\frac{3\pi V}{2}}$

(D) $\sqrt[3]{\frac{6V}{\pi}}$ (E) $\sqrt[3]{6\pi V}$

33. The largest set of real numbers x for which $f(x) = \ln\sqrt{\pi - 4\tan^{-1}x}$ is defined is:

(A) $(-\infty, 1)$ (B) $(-\infty, 1]$ (C) $(0, 1)$

(D) $(1, \infty)$ (E) $[1, \infty)$

34. Simplify: $\dfrac{3 - 7i}{4 + 5i}$

(A) $\frac{47}{9} + \left(\frac{13}{40}\right)i$ (B) $\frac{23}{9} + \left(\frac{43}{40}\right)i$

(C) $-\frac{58}{23} + \left(\frac{58}{43}\right)i$ (D) $-\frac{23}{41} - \left(\frac{43}{41}\right)i$

(E) $-\frac{23}{58} + \left(\frac{43}{58}\right)i$

35. Let A and B be real numbers with $A^2 = B^2$. Then $(A + iB)^{10}$ equals:

(A) $A^{10} - B^{10}$

(B) $A^{10} + B^{10}$

(C) $(A^2 + B^2)^5 + i(A^2 + B^2)^5$

(D) $(A^2 - B^2)^5 + i(A^2 - B^2)^5$

(E) $i(32A^5B^5)$

36. The equation $\begin{vmatrix} 1+x & 1 & 1 \\ 1 & 1+x & 1 \\ 1 & 1 & 1+x \end{vmatrix} = 0$ has:

(A) three distinct roots

(B) at least one irrational root

(C) a pair of complex roots

(D) all positive roots

(E) none of the above

37. The solution set for the equation $\sin 2\theta + \sin\theta = 0$ on the interval $[0, 2\pi)$ is:

(A) $\left\{0, \frac{\pi}{3}, \pi, \frac{5\pi}{3}\right\}$

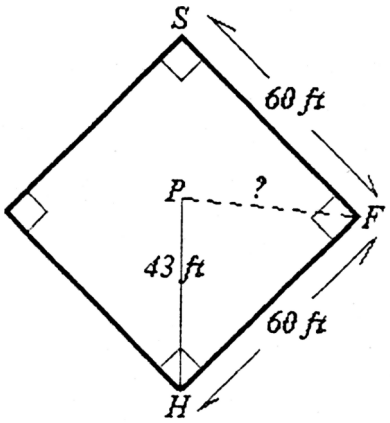
(B) $\left\{0, \frac{\pi}{2}, \pi, \frac{3\pi}{2}\right\}$

(C) $\left\{0, \frac{\pi}{3}, \frac{\pi}{2}, \frac{2\pi}{3}\ \pi\right\}$

(D) $\left\{0, \frac{2\pi}{3}, \pi, \frac{4\pi}{3}\right\}$

(E) $\left\{0, \frac{2\pi}{3}, \pi, \frac{4\pi}{3}, 2\pi\right\}$

38. The diamond of a woman's softball field is a square, 60 ft on a side. The pitcher's mound (P) is 43 ft from the home plate (H), as shown in the figure. How far is the pitcher's mound (P) from the first base (F), if rounded to one decimal place? [Notice that the pitcher's mound (P) is *not* halfway between home plate (H) and the second base (S).]



(A) 42.1 (B) 42.2 (C) 42.3

(D) 42.4 (E) 42.5

39. Find the quotient obtained by dividing $8x^3 - 4x + 39$ by $2x + 3$.

(A) $4x^2 + 6x + 7$ (B) $4x^2 - 6x - 7$

(C) $4x^2$ (D) $4x^2 - 6x + 7$

(E) 18

40. A child piles 91 cylindrical bars in layers so that the top layer contains one bar, and each lower layer has one more bar than the one above it. How many bars are there in the lowest layer?

(A) 9 (B) 11 (C) 12

(D) 13 (E) 14

41. Soft drink cans are stacked on their sides. The pile is stacked with 30 cans on the bottom, 29 in the second row, 28 in the third row, and so forth. How many cans would be needed for the stack to form an isosceles triangle?

(A) 465 (B) 450 (C) 420

(D) 434 (E) 480

42. In doing arithmetic to a certain base, a student finds that the square of the number represented by 16 is represented by 230. She was working in one of the following bases. Which one?

(A) eight (B) nine (C) twelve

(D) fourteen (E) sixteen

43. If a, b, and c are natural numbers such that $a < b$ and $b < c$, then which of the following is *false*?

(A) $c > a$ (B) $ab < bc$

(C) $-a > -c$ (D) $-\frac{a^2}{b} > -\frac{c^2}{b}$

(E) $\left(-\frac{a}{b}\right)^2 > \left(-\frac{c}{b}\right)^2$

44. In how many ways can 12 different books be divided equally among 3 different children?

(A) 34,650 (B) 1485 (C) 4096

(D) 3456 (E) 924

45. Of the 354 surveys returned by a group of college students, 294 indicated they liked mathematics, 188 liked English, 196 like history, 148 liked both mathematics and English, 92 liked all three subjects, 175 liked both history and mathematics; and 9 liked history and disliked both mathematics and English. How many disliked English or history?

(A) 175. (B) 250. (C) 176.

(D) 11. (E) 74.

46. Given the statement: "If Mary can vote, then Mary is over 18". Which of the following are then necessarily true?

(A) If Mary cannot vote, she is not over 18

(B) If Mary is over 18, she can vote

(C) Either Mary can vote, or she is not over 18

(D) Either Mary can vote, or she is over 18

(E) If Mary is not over 18, then she cannot vote

47. If a train travels m miles in 5 hours, how many miles will it travel in k hours at the same rate?

(A) $\frac{k}{5m}$ (B) $\frac{5m}{k}$ (C) $\frac{5k}{m}$

(D) $\frac{m}{5k}$ (E) $\frac{km}{5}$

48. A river 1 kilometer wide has a constant current of 5 kilometers per hour. At approximately what angle to the shore should a person head a boat that is capable of maintaining a speed of 15 kilometers per hour in order to reach a point directly opposite?

(A) 60° (B) 70.5° (C) 72°

(D) 76.5° (E) 81°

49. A car radiator which holds 5 gallons is filled with a mixture of 30% antifreeze and 70% water. How much of this mixture should be drained and replaced with pure (100%) antifreeze so that the radiator will be filled with a mixture which is 70% antifreeze and 30% water?

(A) 2.14 gal (B) 2.86 gal (C) 5 gal

(D) 4 gal (E) 1.5 gal

50. Find x so that $5x + 9$ is midway between $x + 3$ and $4 - 2x$. x is in the interval:

(A) $(-2, 0)$ (B) $(0, 5)$

(C) $(5, 10)$ (D) $(10, 20)$

(E) none of the above