October 26, 2003

1. The distance from point A to point B is 10 feet. The distance from point B to point C is 8 feet. Which could NOT be the distance (in feet) from point A to point C?

a) 2 b) 8 c) 16 d) 18 e) none of these

2. The sum of two numbers is two. The difference of the two numbers is one. The product of the two numbers is $\frac{a}{b}$ where $\frac{a}{b}$ is in lowest terms and $0 < a < b$. Find ab.

a) 10 b) 12 c) 16 d) 18 e) none of these

3. If $x = -7$ and $\frac{1}{2y} = -14$, find y in terms of x.

a) $x - 7$ b) $2x - 7$ c) $\frac{1}{2x}$ d) $\frac{1}{4x}$ e) none of these

4. Find $3042_5 + 2340_5$.

Hint: If 123 is a number in base 4, then we can write $123_4 = 3(4)^0 + 2(4)^1 + 1(4)^2$
$123_4 = 27_{10}$

a) 5382_5 b) 10432_5 c) 1432_5 d) 742_5 e) none of these

5. Sam can paint a room in 7 hours. Emily can paint the room in 5 hours. It should take them x minutes to paint the room if they work together. Find x.

a) 180 b) 175 c) 170 d) 165 e) none of these

6. If $(a,b,c) = a + b - c$, then $\big((1,3,4),(2,8,4),(3,1,2)\big)$ equals

a) 4 b) 5 c) 6 d) 10 e) none of these

7. If x, y, and $\frac{y}{x}$ are all positive integers, how many DISTINCT ordered pairs (x, y) will satisfy the equation $x + y = 24$?

a) 7 b) 6 c) 5 d) 4 e) none of these

8. Find $a^2 + b^2$ whenever $(a-b)^2 = 64$ and $ab = 3$.

a) 74 b) 72 c) 70 d) 68 e) none of these

9. Three of the sides of a square are line segments which are contained in the straight lines having equations

$$y = -x + 6$$
$$y = x + 4$$
$$y = -x + 10$$

Which of these could be an equation of the straight line which contains the fourth side of this square?

a) $y = x + 6$ b) $y = x + 10$ c) $y = x - 10$ d) $y = x$ e) none of these

10. The largest possible circle is cut out of a square piece of tin with perimeter 8 inches and this circular piece of tin is sold to a banker. If the total area of the tin remaining is x square inches where x is rounded to the nearest 0.001, find x.

a) 0.854 b) 0.856 c) 0.858 d) 0.860 e) none of these

11. Find the area of a circle whose diameter equals four times the reciprocal of the circumference.

a) π^2 b) π c) 1 d) $\frac{1}{\pi}$ e) none of these

12. If a, b, and c are consecutive odd integers where $a < b < c$, find the value of $a^2 - 2b^2 + c^2$.

a) 10 b) 8 c) 6 d) 4 e) none of these

13. Find the sum of the digits of the constant c in the equation $x^2 = 18x - c$ if one root is five times the other root.

a) 10 b) 9 c) 8 d) 7 e) none of these

14. If $i^2 = -1$, simplify $\frac{i}{i-2}$ and put the final answer in the form $x + yi$. Find $3x - 5y$.

a) 2.6 b) 2.8 c) 3 d) 3.2 e) none of these

15. Line A has equation $8(y-2) = 3(x+1)$. Line B is perpendicular to line A and line B passes through the point where line A intersects the *x*-axis. The equation of line B is $y = mx + b$. Find $m - b$.

a) $\frac{-19}{3}$ b) $\frac{-160}{9}$ c) $\frac{128}{9}$ d) $\frac{160}{9}$ e) none of these

16. $11^{5x+6} = 22^{8x+7}$ Find the sum of the digits of $\lfloor 1000x \rfloor$ where *x* is rounded to the nearest 0.001.

a) 21 b) 20 c) 19 d) 18 e) none of these

17. Given triangle ABC with vertices (0, 0), (3, 1), and (1, 5) with area K and perimeter P. Find $P + K$. Round the final answer to the nearest 0.001.

a) 19.729 b) 19.730 c) 19. 731 d) 19.732 e) none of these

18. The solution set for $\sqrt{3}\csc 2x^\circ = 2$ over the domain $0^\circ \le x^\circ < 360^\circ$ is $\{a^\circ, b^\circ, c^\circ, d^\circ\}$ where $a < b < c < d$. Find $-a + b + c + d$.

a) 540 b) 510 c) 480 d) 440 e) none of these

19. $\lim_{h\to 0}\dfrac{\sqrt[3]{8+h}-2}{h}$

a) 12^{-1} b) 16^{-1} c) 18^{-1} d) 0 e) none of these

20. An airplane has an airspeed of 450 mph and is pointed in the direction N 30° E [30° east of north]. The wind is 20 mph FROM the west. The ground speed of this plane is x mph where x is rounded to the nearest 0.1 mph. Find x.

a) 460.3 b) 460.4 c) 460.5 d) 460.6 e) none of these

21. There are 3 different roads from town A to town B and 4 different roads from town B to town C (a total of 7 different roads). How many different round trip routes are possible in going from A to B to C to B to A in that order without being on the same road more than once during any one round trip route?

a) 144 b) 72 c) 36 d) 18 e) none of these

22. Find $\dfrac{d^2y}{dx^2}$ at $\theta = 2$ for the curve with parametric equations $\begin{aligned} 3x &= \theta^3 \\ 4y &= 4\theta - \theta^4 \end{aligned}$.

a) $\dfrac{-1}{4}$ b) $\dfrac{-5}{16}$ c) $\dfrac{-3}{8}$ d) $\dfrac{-7}{16}$ e) none of these

23. If the point (P, Q) is on the graph of $f(x) = y$ in the (x, y) plane, then $f\left(\dfrac{a}{b}x\right) = \dfrac{c}{d}y$ <u>must</u> have what point?

a) $\left(\dfrac{aP}{b}, \dfrac{cQ}{d}\right)$ b) (abP, cdQ) c) $\left(\dfrac{bP}{a}, \dfrac{dQ}{c}\right)$ d) $\left(\dfrac{P}{ab}, \dfrac{Q}{cd}\right)$ e) none of these

24. If $\dfrac{7x^2-23x+10}{(3x-1)(x-1)(x+2)} = \dfrac{A}{3x-1} + \dfrac{B}{x-1} + \dfrac{C}{x+2}$ is true for all x except those which cause denominators to equal zero, find $A+B+C$.

a) $\dfrac{3}{2}$ b) 2 c) $\dfrac{5}{2}$ d) 3 e) none of these

Solutions:

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