

1. The 3 real number solutions of  $18x^3 = 8x$  are  $a$ ,  $b$ , and  $c$  where  $a < b < c$ .

Find  $6a + 12b + 18c$ .

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

2. Find the area of the rectangle whose perimeter is 25 and whose width exceeds the length by 5.

- a) 32.7500              b) 32.8125              c) 32.8750              d) 32.9375              e) None of these

3. The graphs of  $\frac{2}{x} = 3y + 4$  and  $\frac{5}{x} + 7y = 1$  intersect at  $\left(\frac{a}{b}, c\right)$  in the fourth quadrant where  $a$  and  $b$  are relatively prime positive integers. Find  $a + b$ .

- a) 57                      b) 58                      c) 59                      d) 60                      e) None of these

4. Given:  $\left|\frac{2x-3}{5}\right| \leq 9$ . Which answer choice below is NOT a member of the solution set?

- a) 24                      b) -19                      c) -21                      d) -22                      e) None of these

5. Given:  $2x + 3y < 6$ . Which answer choice below is NOT a member of the solution set?

- a) (-1, 2)              b) (0,  $1.9\overline{8}$ )              c) (1, 1)              d) (2, 0)              e) None of these

6. When  $\sqrt{\frac{18}{5}} - \sqrt{\frac{5}{18}}$  is written in simplest radical form as  $\frac{a}{b}\sqrt{c}$  where  $a$ ,  $b$ , and  $c$  are positive integers, and  $\frac{a}{b}$  is in lowest terms, find  $a + b + c$ .

- a) 53                      b) 55                      c) 57                      d) 59                      e) None of these

7. Find  $54x^{-4/3}$  where  $x$  is the real root of  $8^{1/6} + x^{1/3} = \frac{7}{3 - \sqrt{2}}$ .

- a) 27                      b) 9                      c) 3                      d)  $\frac{2}{3}$                       e) None of these

8. Find the sum of two numbers where 3 times the reciprocal of the first number plus 5 times the reciprocal of the second number is 17. Also, twice the product of the two numbers equals the first number plus twice the second number.

- a) -0.80                      b) -0.75                      c) -0.70                      d) -0.65                      e) None of these

9. Find the set of all positive real solutions of the equation  $\frac{\sqrt{x+1} + \sqrt{x-1}}{\sqrt{x+1} - \sqrt{x-1}} = 3$ .

- a)  $\{ \}$                       b)  $\left\{ \frac{4}{3} \right\}$                       c)  $\left\{ \frac{5}{3} \right\}$                       d)  $\left\{ \frac{13}{9} \right\}$                       e) None of these

10. Find the SUM of the 2 values of  $p$  such that the distance from  $(8, p)$  to  $(3, -5)$  is 13.

- a) 10.5                      b) 11                      c) 11.5                      d) 12                      e) None of these

11. Given:  $f(x) = (x+1)^2 - 200x^{-1}$ . Find  $m + b$  where  $y = mx + b$  is the equation of the line through  $(5, f(5))$  and parallel to the line  $\frac{x}{2} - \frac{y}{5} = 1$ .

- a) -12                      b) -14                      c) -16                      d) -18                      e) None of these

12. Find the largest positive integer  $x$  such that the quantity  $(x+1)^2(x+23)^{-1}$  is also a positive integer.

- a) 484                      b) 483                      c) 461                      d) 44                      e) None of these

13. A rubber ball is dropped vertically from a height of 100 inches. On each rebound the ball rises to  $\frac{5}{6}$  of the height from which it last fell. Find the distance traveled by the ball in coming to rest.

- a)  $1083.\overline{3}$  in      b) 1100 in      c)  $1116.\overline{6}$  in      d)  $1133.\overline{3}$  in      e) None of these

14. Find the numerical coefficient of the term involving  $\frac{a^3}{x^3}$  from the expansion of  $\left(y^3 + \frac{3a}{x}\right)^7$ .

- a) 35      b) 945      c) 1263      d) 5670      e) None of these

15. The centroid of triangle ABC is located at (5, -2). The circumcenter of triangle ABC is located at (11, 8). The orthocenter of triangle ABC is located at (a, b). Find  $ab$ .

- a) 154      b) 160      c) 164      d) 168      e) None of these

16. Triangle ABC has sides 5 in, 12 in, and 13 in. The area of the “ring” formed by the incircle and the circumcircle is  $x\pi$  square inches. Find  $x$ .

- a) 12      b) 14      c) 16      d) 18      e) None of these

17. Find the area of the circumcircle of the triangle with angles  $50^\circ$ ,  $60^\circ$ , and  $70^\circ$  whose shortest side is 5. Round your final answer to the nearest 0.001 square unit of area.

- a) 33.458      b) 33.460      c) 33.462      d) 33.464      e) None of these

18. M men work for H hours to make W widgets. IF Q of these workers quit, find the number of hours needed for those remaining on the job to make 133 widgets.

- a)  $\frac{133HM}{WM - WQ}$       b)  $\frac{133HM}{WQ - WM}$       c)  $\frac{133HM}{WM + WQ}$       d)  $\frac{WM - WQ}{133HM}$       e) None of these

19. Find the length of the arc of  $y - 1 = (x - 2)^2$  from  $x = 3$  to  $x = 6$ . Round the final answer to the nearest 0.001 unit.

- a) 15.340      b) 15.342      c) 15.344      d) 15.346      e) None of these

20. Given:  $M(x) = \int_{1-3x}^1 \frac{u^3}{1+u^2} du$ . Find  $M'(1)$ .

- a) -4.6      b) -4.8      c) -5      d) -5.2      e) None of these

21. Find the sum of the positive integers which are exact divisors of 200,000.

- a) 496062      b) 496064      c) 496066      d) 496068      e) None of these

22. Given the hyperbola  $36y^2 = 25x^2 + 3600$ : The asymptotes are  $y = \pm mx$  and the vertices are  $(0, \pm a)$  where  $m$  and  $a$  are both positive. Also, the foci are  $(0, \pm \sqrt{c^2})$ . Find  $mc^2 + ma + m$ .

- a) 210      b) 211      c) 212      d) 213      e) None of these

23. A right triangle is formed by the positive  $x$ -axis, the positive  $y$ -axis, and a line containing  $(11, 8)$ . Find the minimum area (in square units) for such a triangle.

- a) 88      b) 160      c) 176      d) 352      e) None of these

24. The region in the first quadrant bounded by  $8x = y^2$ , the positive  $x$ -axis, and the upper half of the latus rectum is rotated about the positive  $y$ -axis. Find the volume generated. Round the answer to the nearest 0.001 cubic unit.

- a) 40.210      b) 40.212      c) 40.214      d) 40.216      e) None of these

**Solutions**

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