1. If a number eight times as large as x is increased by two, and one-fourth of this result equals 16, find $3x + 17$.

a) 40 b) 40.25 c) 40.5 d) 40.75 e) none of these

2. Find x where $x!$ is the product of 6! and 7!.

a) 42 b) 21 c) 13 d) 9 e) none of these

3. Find the number of diagonals in a regular polygon with 9 sides.

a) 72 b) 54 c) 36 d) 27 e) none of these

4. Ten people are entered in a race. If there are no ties, how many different ways can the first two places come out (winner and runner-up)?

a) 100 b) 95 c) 90 d) 80 e) none of these

5. Find the distance between two positive integers whose sum is 73 and where the larger divided by the smaller yields a quotient of 3 and a remainder of 13.

a) 40 b) 41 c) 42 d) 43 e) none of these

6. Find the square of the product of two positive numbers if the sum of their reciprocals is ½ and the difference of their reciprocals is ⅙.

a) 324 b) 289 c) 256 d) 225 e) none of these

7. A can do a job in 21 hours working alone and B can do the same job in 14 hours working alone. How many hours will it take B to finish the job if A starts the job and works for 7 hours and then quits?

a) 9 b) $9\frac{1}{3}$ c) $9\frac{2}{3}$ d) 10 e) none of these

8. $A = 3^x + 3^x + 3^x$. Find A^3.

a) 81^{3x} b) 27^{3x} c) 27^{x+1} d) 9^{6x} e) none of these

9. Find $a + b + c + d$ whenever $f(x) = a(x-b)(x-c)(x-d)$, $f(1) = f(2) = f(-2) = 0$ and $f(0) = 3$.

a) $\frac{3}{4}$ b) $\frac{7}{4}$ c) $\frac{11}{4}$ d) $\frac{15}{4}$ e) none of these

10. Each of 3 circles with radius 3 is externally tangent to the other two. All three circles are inside an equilateral triangle and each circle is tangent to 2 of the 3 sides of the triangle. Find the perimeter of this triangle.

a) $36 + 9\sqrt{3}$ b) $27 + 9\sqrt{3}$ c) $27 + 18\sqrt{3}$ d) $18 + 18\sqrt{3}$ e) none of these

11. Reduce $\frac{2x^3 + 9x^2 + 7x - 6}{2x^3 - 8x - x^2 + 4}$.

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

12. Solve for x: $8^{x^2-2x} = \frac{1}{2}$

a) $1 \pm \frac{\sqrt{6}}{3}$ b) ± 1 c) $\frac{4}{3}, \frac{-1}{3}$

d) no real solutions e) none of these

13. The functions $f(x) = 2\sin(3x+4)+1$ and $g(x) = 4\cos(3x+2)$ have the same

a) centerline b) range c) amplitude d) period e) none of these

14. If *a* is positive, *b* is negative, and $a\sqrt{5} + b\sqrt{-5} = 5 - \sqrt{-1}$, then *a* – *b* equals

a) $\frac{5\sqrt{5}}{4}$ b) $\frac{6\sqrt{5}}{5}$ c) $\sqrt{5}$ d) $\frac{4\sqrt{5}}{5}$ e) none of these

15. Find the equation of the parabola with focus (1, -11) and vertex (1, -5).

a) $x^2 - 2x + 6y = -31$ b) $x^2 + 2x + 24y = 119$
c) $x^2 - 2x + 24y = -121$ d) $x^2 - 2x - 24y = 119$ e) none of these

16. Find the equation of the hyperbola with center (0, 0), vertices (±3, 0), and foci $\left(\pm 3\sqrt{5}, 0\right)$.

a) $\frac{x^2}{9} - \frac{y^2}{45} = 1$ b) $\frac{y^2}{9} - \frac{x^2}{45} = 1$ c) $\frac{x^2}{9} - \frac{y^2}{36} = 1$
d) $\frac{x^2}{9} - \frac{y^2}{54} = 1$ e) none of these

17. $x^4 + bx^3 + cx^2 + dx + e = 0$ where *b*, *c*, *d*, and *e* are real numbers has solutions –1, 2, and $\sqrt{-1}$. Find b – c + d – e.

a) 1 b) 2 c) 3 d) 4 e) none of these

18. The solutions of $\cos^2\theta + \cos 2\theta = \frac{5}{4}$ over the domain $0° \le \theta < 360°$ are $\{a°, b°, c°, d°\}$ where a < b < c < d. Find 10a + 9b + 2c –d.

a) 1640 b) 1690 c) 1740 d) 1790 e) none of these

19. Find c such that $\int_1^c \sqrt{x^7 + x^4}\,dx = 6 - \frac{4\sqrt{2}}{9}$.

a) $\sqrt{2}$ b) 2 c) 4 d) 9 e) none of these

20. Find the area of the region bounded by $f(x) = 5x - x^2$ and $g(x) = 3x^2 + x$.

a) $2/3$ b) $13/6$ c) 6 d) $1/6$ e) none of these

21. Find the slope of the line through the point (4, 3) which forms a right triangle with the positive x- and positive y-axis where this right triangle will have the least possible area.

a) $4/3$ b) $-4/3$ c) $3/4$ d) $-3/4$ e) none of these

22. Newton's method uses the x intercept of the tangent line to give a better approximation of the root. If Newton's method is applied to the equation $x^3 = 65$ to find the cube root of 65 and our first guess is 4, what approximation do we get for the cube root of 65 by doing exactly one iteration of Newton's method?

a) $193/48$ b) $257/64$ c) $289/72$ d) $385/96$ e) none of these

23. Of 164 students, 72 took algebra, 55 took biology, 82 took chemistry, 4 took all 3 subjects, 40 took only algebra, 31 took only biology, and 52 took only chemistry. If everyone took at least one of these 3 subjects, how many took algebra and biology but NOT chemistry?

a) 11 b) 13 c) 15 d) 17 e) none of these

24. Simplify $\frac{\sin 4\theta + \sin 6\theta}{\cos 4\theta + \cos 6\theta}$.

a) $\tan 2\theta$ b) $\tan 5\theta$ c) $\tan 10\theta$ d) $\tan 12\theta$ e) none of these

Solutions

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