

1. Which of the following is true?

- A. If $A \cup B = A$ then $B \subseteq A$.
- B. If $A \cap B = \emptyset$ then $A = B = \emptyset$.
- C. If $A \cup B = U$ then A or B is U.
- D. If $A \cup B = U$ then $A \cap B = \emptyset$.
- E. Both A and C are correct.
- F. None of the above.

2. Let $f = \left\{ (x, y) \in \mathbf{R} \times \mathbf{R} \mid y = \frac{|x-1|}{x-1} \right\}$. Which of the following is true?

- A. $D_f = \mathbf{R}$; $R_f = \mathbf{R}$
- B. $D_f = \mathbf{R} - \{1\}$; $R_f = \{1, -1\}$
- C. $D_f = \mathbf{R} - \{1\}$; $R_f = \mathbf{R}$
- D. $D_f = \mathbf{R}$; $R_f = \{1, -1\}$
- E. $D_f = \mathbf{R} - \{0\}$; $R_f = \mathbf{R}$
- F. None of the above

3. Let $|2x^2 - x - 3| = 3 + x - 2x^2$. Find the value of x .

- A. $\left[\frac{-3}{2}, 1 \right]$
- B. $\left[-1, \frac{3}{2} \right]$
- C. $\left(-1, \frac{3}{2} \right)$
- D. $\left[\frac{3}{2}, 1 \right]$
- E. $\left[-1, \frac{3}{2} \right)$
- F. None of the above

4. Solve $\log_3(4x-7) = 2$.

- A. $x = 9$
- B. $x = 16$
- C. $x = 0.5$
- D. $x = 6$
- E. $x = 4$
- F. None of the above

5. Solve the inequality $|2x-5|>3$.

- A. $[1,4]$ B. $(-\infty,1)$
C. $\{x|x<1 \text{ or } x>4\}$ D. $(4,\infty)$
E. $\{x|x<-1 \text{ or } x>4\}$ F. $(1,4)$

6. How many times does the graph of $f(x) = x^3 + x^2 - 12$ intersect the x -axis?

- A. 0 B. 1
C. 2 D. 3
E. 4 F. 5

7. Let $f(x) = 2x+3$. If $\int_{-1}^{\theta} f(x) dx = 2f(\theta)$, then (θ) is equal to _____.

- A. 7 B. 9
C. 11 D. 13
E. 15 F. 17

8. Find the distance between the points $(-2,1)$ and $(2,3)$

- A. $4\sqrt{2}$ B. $5\sqrt{2}$
C. $2\sqrt{5}$ D. $\sqrt{5}$
E. 4 F. 2

9. For the function defined by $f(x) = 2x^2 - 3x$, evaluate $\frac{f(x+h) - f(x)}{h}$.

- A. $\frac{2(x+h)^2 - 3x}{h}$
B. $4x+2h-3$
C. $4xh+2h^2-3h$
D. $2h^2 - 3\frac{x}{h}$
E. $2x^2 - 3x$
F. None of the above.

10. Find the domain of a function $h(t) = \sqrt{4-3t}$.

- A. $\left[-\frac{4}{3}, \infty\right)$ B. $\left[\frac{4}{3}, \infty\right)$
C. $\left(-\infty, -\frac{4}{3}\right]$ D. $\left(-\infty, \frac{4}{3}\right]$
E. $(-\infty, \infty)$ F. None of the above

11. Find the sum of $\sum_{k=1}^{100} 2k$.

- A. 10,050 B. 5,000
C. 5,050 D. 20,100
E. 10,000 F. 10,100

12. Of the following, which is greater than $\frac{1}{2}$?

- A. $\frac{2}{5}$ B. $\frac{4}{7}$
C. $\frac{4}{9}$ D. $\frac{5}{11}$
E. $\frac{6}{13}$ F. None of the above

13. If $x^2 - y^2 = 55$ and $x - y = 11$, then $y = ?$

- A. 8 B. 5
C. 3 D. -8
E. -3 F. -5

14. Which inequality below is true?

- A. $2^{1000} < 3^{600} < 10^{300}$
B. $3^{600} < 2^{1000} < 10^{300}$
C. $3^{600} < 10^{300} < 2^{1000}$
D. $10^{300} < 2^{1000} < 3^{600}$
E. $10^{300} < 3^{600} < 2^{1000}$
F. None

15. If $\tan(\arccos x) = \sqrt{3}$, find $x \cos(\arccos x/2)$.

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|----|--------------|----|---------------|
| A. | $\sqrt{3}/8$ | B. | $\sqrt{3}/4$ |
| C. | $\sqrt{3}/2$ | D. | $\sqrt{3}$ |
| E. | $2\sqrt{3}$ | F. | None of these |

16. Let $f(x) = \sin(x)$, compute $\frac{1}{2\pi} \int_0^{2\pi} f(x)^2 dx$.

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|----|----|----|-------------------|
| A. | -1 | B. | -0.5 |
| C. | 0 | D. | 0.5 |
| E. | 1 | F. | None of the above |

17. Let $\begin{bmatrix} 2 & 0 \\ -1 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 4 \\ -1 \end{bmatrix}$, and find $x^2 + y^2$.

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|----|----|----|----|
| A. | 25 | B. | 20 |
| C. | 13 | D. | 5 |
| E. | 4 | F. | 2 |

18. Evaluate $\frac{x^4 - 3x^3 + 2x - 5}{x^2 - x + 1}$

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|----|--|----|--|
| A. | $x^2 - 4x - 5 + \frac{3x - 10}{x^2 - x + 1}$ | B. | $\frac{x^2 - 4x - 5}{x^2 - x + 1} + 3x - 10$ |
| C. | $x^2 + 2x + 3$ | D. | $\frac{x^2 - 2x - 3}{x^2 - x + 1} + x - 2$ |
| E. | $x^2 - 2x - 3 + \frac{x - 2}{x^2 - x + 1}$ | F. | None of the above |

19. Which term of the following equals to $\left(\frac{x^{-3}}{3y^{-1}}\right)^{-2}$ if $x \neq 0$ and $y \neq 0$?

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|----|--------------------|----|--------------------|
| A. | $\frac{x^5}{9y^3}$ | B. | $\frac{x^9}{9y^2}$ |
| C. | $\frac{9x^5}{y^3}$ | D. | $\frac{9x^6}{y^2}$ |
| E. | $\frac{x^6}{9y^2}$ | F. | None of the above |

20. Evaluate $\frac{x^2 - 2x + 1}{x^3 + x} \times \frac{4x^2 + 4}{x^2 + x - 2}$.

A. $\frac{4(x-2)}{x(x+1)}, x \neq -1, 0, 2$

B. $\frac{4(x-1)}{x(x+2)}, x \neq -2, 0, 1$

C. $\frac{4(x-1)}{x(x-2)}, x \neq -2, -1, 0$

D. $\frac{4(x+1)}{x(x+2)}, x \neq -2, -1, 0$

E. $\frac{4(x+1)}{x(x-2)}, x \neq -1, 0, 2$

F. None of the above

21. Solve the inequality $-5 < 3x - 2 < 1$.

A. $\{x \mid -3 < x < 1\}$

B. $\{x \mid -1 < x < 3\}$

C. $\{x \mid -3 \leq x \leq 3\}$

D. $\{x \mid -1 \leq x \leq 1\}$

E. $\{x \mid -3 < x < 3\}$

F. $\{x \mid -1 < x < 1\}$

22. Find an equation of the line that contains the point $(1, -2)$ and is perpendicular to the line $x + 3y = 6$

A. $y = 3x - 5$

B. $y = -3x - 5$

C. $y = 3x - 2$

D. $y = -3x - 2$

E. $y = -\frac{1}{3}x - 2$

F. $y = \frac{1}{3}x - 2$

23. What are the values of i^{27} and i^{101} ?

A. i and 1

B. 1 and $-i$

C. $-i$ and i

D. i and $-i$

E. $-i$ and $-i$

F. i and i

24. Suppose that $f(x) = 2x^2 - 3$ and $g(x) = 4x$. Find $(g \circ f)(1)$.

A. 29

B. -1

C. -16

D. 47

E. -4

F. 0

25. Solve $e^{-x^2} = (e^x)^2 \cdot \frac{1}{e^3}$.

- A. $x = 0$ or $x = 1$ B. $x = -3$ or $x = 1$
C. $x = 3$ or $x = -1$ D. $x = 0$ or $x = -1$
E. $x = 1$ or $x = -1$ F. None of the above

26. Find the exact value of $\log_3 \frac{1}{27}$.

- A. $\sqrt{3}$ B. $-\sqrt{3}$
C. 9 D. -9
E. 3 F. -3

27. Find the value of the 3 by 3 determinant: $\begin{vmatrix} 3 & 4 & -1 \\ 4 & 6 & 2 \\ 8 & -2 & 3 \end{vmatrix}$

- A. 106 B. 138
C. 26 D. 132
E. 82 F. -14

28. Solve the following system of equations: $\begin{cases} x^2 + y^2 = 13 \\ x^2 - y = 7 \end{cases}$

- A. $y = -3$ or $y = 2$
B. $y = -2$ or $y = 2$
C. $y = -2$ or $y = 3$
D. $y = -1$ or $y = 1$
E. $y = -2$ or $y = -3$
F. None of the above

29. How many different vertical arrangements can be made from 8 flags, if 4 are white, 3 are blue, and 1 is red?

- A. 96 different arrangements
- B. 144 different arrangements
- C. 280 different arrangements
- D. 24 different arrangements
- E. 48 different arrangements
- F. 336 different arrangements

30. If $2x^3 - 3x^2 - 5x + 6 = 0$ can be written in the form of $(x - a)(2x - b)(x - c) = 0$.

Find the value of abc .

- A. -6
- B. -5
- C. 5
- D. 6
- E. 0
- F. None of the above

31. Let $-4 < x^2 - 5x < 36$ Which of the following is the set of the solution?

- A. $(-\infty, 1) \cup (9, \infty)$
- B. $(-4, 1) \cup (4, 9)$
- C. $(-4, 1) \cup (1, 4)$
- D. $(-\infty, -4) \cup (9, \infty)$
- E. $(-\infty, -4) \cup (1, 9)$
- F. None of the above

32. Let $(f + g)(x) = 2x + 1$ and $(f - g)(x) = 3 - 4x$. Find $(f \cdot g)(x)$.

- A. $x^2 - 7x + 6$
- B. $-x^2 - 7x + 6$
- C. $3x^2 - 7x + 2$
- D. $x^2 + 7x - 6$
- E. $3x^2 + 7x - 2$
- F. $-3x^2 + 7x - 2$

33. Let $f(x) = \sqrt{x}$, $g(x) = x - 3$. Which of the following is true?

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|----|-------------------------------|----|-----------------------------------|
| A. | $(g \circ f)(x) = \sqrt{x-3}$ | B. | $(f \circ g)(x) = (g \circ f)(x)$ |
| C. | $D_{g \circ f} = [0, \infty)$ | D. | $D_{f \circ g} = (-3, \infty)$ |
| E. | C and D are correct | F. | None of the above |

34. Let $f(x) = 2x + 3$. If $\int_{-1}^{\theta} f(x) dx = 2f(\theta)$, then θ is equal to _____.

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|----|----|----|----|
| A. | 7 | B. | 9 |
| C. | 11 | D. | 13 |
| E. | 15 | F. | 17 |

35. The function of f is defined as $f(x) = \begin{cases} -x+1 & \text{if } -1 \leq x < 1 \\ 2 & \text{if } x = 1 \\ x^2 & \text{if } x > 1 \end{cases}$

Determine the domain of f .

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|----|------------------------|----|----------------------------|
| A. | $\{x \mid x \geq 1\}$ | B. | $\{x \mid x \leq -1\}$ |
| C. | $\{x \mid x \leq 1\}$ | D. | $\{x \mid x \geq 0\}$ |
| E. | $\{x \mid x \geq -1\}$ | F. | $\{x \mid -1 \leq x < 1\}$ |

36. Find a unit vector in the same direction as $\mathbf{v} = 4\mathbf{i} - 3\mathbf{j}$.

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|----|---|----|---|
| A. | $\frac{4}{5}\mathbf{i} + \frac{3}{5}\mathbf{j}$ | B. | $\frac{3}{5}\mathbf{i} + \frac{4}{5}\mathbf{j}$ |
| C. | $\frac{3}{5}\mathbf{i} - \frac{4}{5}\mathbf{j}$ | D. | $\frac{4}{5}\mathbf{i}$ |
| E. | $-\frac{3}{5}\mathbf{j}$ | F. | $\frac{4}{5}\mathbf{i} - \frac{3}{5}\mathbf{j}$ |

37. If $\mathbf{v} = 2\mathbf{i} + 3\mathbf{j} + 5\mathbf{k}$ and $\mathbf{w} = \mathbf{i} + 2\mathbf{j} + 3\mathbf{k}$, find $\mathbf{v} \times \mathbf{w}$.

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|----|---|----|---|
| A. | 1 | B. | $\mathbf{i} - \mathbf{j} + \mathbf{k}$ |
| C. | $-\mathbf{i} + \mathbf{j} + \mathbf{k}$ | D. | $-\mathbf{i} - \mathbf{j} - \mathbf{k}$ |
| E. | $-\mathbf{i} - \mathbf{j} + \mathbf{k}$ | F. | $-\mathbf{i} + \mathbf{j} + \mathbf{k}$ |

38. Find the sum of $\sum_{k=1}^4 (k^2 - 7k + 2)$.

- A. -10
- B. -16
- C. -84
- D. -48
- E. -96
- F. -32

39. Assuming equally likely outcomes, calculate the probability of a 3 child family to have 2 boys and 1 girl.

- A. $\frac{1}{3}$
- B. $\frac{1}{8}$
- C. $\frac{1}{2}$
- D. $\frac{5}{8}$
- E. $\frac{3}{8}$
- F. None of the above

40. Evaluate $\lim_{x \rightarrow -2} \frac{4 - x^2}{x^4 - 16}$.

- A. $\frac{1}{8}$
- B. $-\frac{1}{8}$
- C. -8
- D. -16
- E. 16
- F. limit does not exist.
