1. Which of the following is true?

A. If $A \cup B = A$ then $B \subseteq A$.

B. If $A \cap B = \varnothing$ then $A = B = \varnothing$.

C. If $A \cup B = U$ then A or B is U.

D. If $A \cup B = U$ then $A \cap B = \varnothing$.

E. Both A and C are correct.

F. None of the above.

2. Let $f = \left\{ (x, y) \in \mathbf{R} \times \mathbf{R} \;\middle|\; y = \dfrac{|x-1|}{x-1} \right\}$. **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. $\left[\dfrac{-3}{2}, 1\right]$ B. $\left[-1, \dfrac{3}{2}\right]$

C. $\left(-1, \dfrac{3}{2}\right)$ D. $\left[\dfrac{3}{2}, 1\right]$

E. $\left[-1, \dfrac{3}{2}\right)$ 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. $\{x \mid x<1 \text{ or } x>4\}$ D. $(4,\infty)$

E. $\{x \mid x<-1 \text{ or } x>4\}$ 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** $\int_{-1}^{5} f(x)\,dx = 2f(\theta)$ **, then** (θ) **is equal to_____.**

A. 7 B. 9

C. 11 D. 13

E. 15 F. 17

8. **Find the average of change of** $f(x)=2x^3-3x$ **from 1 to** x**.**

A. -1 B. $\frac{x^4}{2}-\frac{3}{2}x^2$

C. $1-2x^3-3x$ D. $2x^3-3x-5$

E. $6x^2-3$ F. $2x-1$

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 ½ ?

A. 2/5 B. 4/7

C. 4/9 D. 5/11

E . 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).

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** $\frac{1}{2\pi}\int_0^{2\pi} f(x)^2 dx$**.**

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** $x^2 + y^2$**.**

A. 25 B. 20

C. 13 D. 5

E. 4 F. 2

18. **If** $\frac{2x-1}{(x-1)(x+2)} = \frac{a}{x-1} + \frac{b}{x+2}$**, find** $a^2 + b^2$**.**

A. 26 B. 20

C. 13 D. 5

E. 4 F. 2

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

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** $\dfrac{x^2-2x+1}{x^3+x}\times\dfrac{4x^2+4}{x^2+x-2}$ **.**

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

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

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

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

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

F. None of the above

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

A. $\{x\,|\,-3<x<1\}$

B. $\{x\,|\,-1<x<3\}$

C. $\{x\,|\,-3\le x\le 3\}$

D. $\{x\,|\,-1\le x\le 1\}$

E. $\{x\,|\,-3<x<3\}$

F. $\{x\,|\,-1<x<1\}$

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

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

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** $e^{-x^2} = \left(e^{x}\right)^{2} \cdot \frac{1}{e^{3}}$.

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

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** $\int_{-1}^{5} f(x)dx = 2f(\theta)$ **, then** θ **is equal to_____.**

A. 7 B. 9

C. 11 D. 13

E. 15 F. 17

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

Determine the domain of f **.**

A. $\{x\mid x\ge 1\}$ B. $\{x\mid x\le -1\}$

C. $\{x\mid x\le 1\}$ D. $\{x\mid x\ge 0\}$

E. $\{x\mid x\ge -1\}$ F. $\{x\mid -1\le x<1\}$

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

A. $\frac{4}{5}\mathbf{i}+\frac{3}{5}\mathbf{j}$ B. $\frac{3}{5}\mathrm{i}+\frac{4}{5}\mathrm{j}$

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** $\mathbf{v}\times\mathbf{w}$ **.**

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** $\sum_{k=1}^{4}\left(k^2-7k+2\right)$**.**

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** $\lim_{x\to -2}\ \frac{4-x^2}{x^4-16}$ **.**

A. $\frac{1}{8}$ B. $-\frac{1}{8}$

C. -8 D. -16

E. 16 F. limit does not exist.

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