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t I (MULTIPLE CHOICES) .Choose the one alternative that best completes the atement or answers the question and encircle your answer (1pt. each=30 Marks).

1. What is the solution set of the equation $\frac{8x+3}{2} - 5(x+2) = -3(x+6)$?

   A. $\{-3\}$
   B. $\{3\}$
   C. $\{6\}$
   D. None of these

2. The solution set of the inequality $0 < (2x-4)^{-1} < \frac{1}{2}$ is the interval

   A. $[3,\infty)$
   B. $(-\infty,3)$
   C. $(3,\infty)$
   D. None of these

3. How long will it take, to the nearest whole year, for money to double if it is invested at 10% compounded monthly? (hint: $\ln(1.008) = 0.0083$ and $\ln 2 = 0.6931$)

   A. 7 years
   B. 8 years
   C. 9 years
   D. 10 years

4. Determine the amplitude and period of $f(x) = -3\cos\left(\frac{x}{5}\right)$. (Angles are measured in radians.)

   A. Amplitude :-3 Period $\frac{2}{5}\pi$
   B. Amplitude :3 Period $\frac{2}{5}\pi$
   C. Amplitude :-3 Period 10π
   D. Amplitude :3 Period 10π

5. What are the real roots of the polynomial $p(x) = 42 + x - x^2$?

   A. -5 and 8
   B. -6 and -7
   C. -5 and -8
   D. -6 and 7

6. If $f(x) = e^{\sqrt{x}}$ and $g(x) = (\ln x)^2$, then which expression is equal to $(f \circ g)(x)$?

   A. $x+1$
   B. $x-1$
   C. x
   D. None of these

Top students

7. Write as a single logarithm : $3\log_4 3 - \log_4 12 + 2$

A. $\log_4 \frac{3}{2}$

B. $\log_4 \frac{9}{64}$

C. $\log_4 18$

D. $\log_4 36$

8. The coefficients of the polynomial $p(x)$ are real numbers .Find the remaining Zeros of p. Degree 5;Zeros:2, i, $-2i$

A. $i, 2i$

B. $2 + i, 2 - 2i$

C. $-i, -2i$

D. $-i, 2i$

9. Write the general polynomial $p(x)$whose only zeros are -1, -2 and -3 with multiplicity 3, 2 and 1, respectively.

A. $p(x) = (x - 3)^3(x - 2)^2(x - 1)$

B. $p(x) = (x + 1)(x + 2)^2(x + 3)^3$

C. $p(x) = (x - 1)^3(x - 2)^2(x - 3)$

D. $p(x) = (x + 1)^3(x + 2)^2(x + 3)$

10. What is the domain for the function $p(x) = \frac{(x-1)^2}{x^3 - 3x^2 + 2x}$?

A. $\{x \in \mathbb{R} : x \neq 0,1,2\}$

B. $\{x \in \mathbb{R} : x \neq 0, -1,2\}$

C. $\{x \in \mathbb{R} : x \neq 0\}$

D. $\{x \in \mathbb{R} : x \neq 0, -1\}$

11. If $f(x) = 3x^2 - 7$ and $g(x) = 2x + a$,find a so that the graph of $(f \circ g)(x)$crosses the y-axis at 5

A. $a = \pm 2$

B. $a = \pm 2\sqrt{3}$

C. $a = \pm 3$

D. None of these

12. Let $p(x) = 2x^3 + 4x^2 - 4x + 1$. According to the rational zero theorem, which number is not a possible zero of p?

A. -1

B. $-\frac{1}{2}$

C. $\frac{1}{2}$

D. 1

Top students

13. If $\log 3 = x$, $\log 5 = y$ and $\log 7 = w$, an algebraic expression in terms of x, y and w for $\log \frac{5}{49\sqrt{3}}$ is

A. $y - 2(x + w)$

B. $y - x + 2w$

C. $y - 2x + 2w$

D. None of these

14. What is the value of x in $7^{\frac{x+2}{x}} = \frac{1}{\sqrt{7}}$?

A. $\frac{1}{2}$

B. $\frac{3}{2}$

C. $-\frac{1}{2}$

D. $\frac{-3}{2}$

15. A survey shows that 63% of the Ethiopians like coffee where as 76% tea. If x% of the Ethiopians like both coffee and tea ,find the value of x

A. $39 \leq x \leq 63$

B. $49 \leq x \leq 73$

C. $24 \leq x \leq 37$

D. None of these

16. Which of the following statements is **not** true?

A. If $A \subseteq B$,then $A \triangle B = A - B$

B. If $A = \emptyset$,then $A \triangle B = B$

C. $a \in \{x\}$ iff $a = x$

D. If $A \subseteq B$,then $C - B \subseteq C - A$

17. If $\sin(\beta) = \frac{3}{5}$ and β lies in the second quadrant, then $\sec(\beta) + \cot(\beta)$ is equal to:

A. $\frac{31}{12}$

B. $\frac{-31}{12}$

C. $\frac{29}{12}$

D. $\frac{-29}{12}$

18. What is the solution set of the equation $\log(x + 3) + \log x = 1$?

A. $\{7,1\}$

B. $\{2,5\}$

C. $\{-5,2\}$

D. $\{2\}$

19. Which of the following expression is a polynomial expression?

A. $x^3 + 6x - \log x$

B. $\frac{4x^4 - 16x^3 - x^2}{\pi x^3}$

C. $4x^4 - 16x^3 - x^{-2}$

D. None of these

20. If $f(x) = 1 + \frac{2}{x-1}$ and $f(k) = 5$,then $f(2k)$ is equal to :

A. -4

B. 4

C. 2

D. -2

Top students

21. If $(\neg r \wedge r) \Leftrightarrow (p \vee q)$ is true, then which one of the following is necessarily true?

A. $\neg q \Leftrightarrow r$

B. $(p \vee q) \Leftrightarrow r$

C. $\neg r \vee q$

D. $r \Rightarrow \neg q$

22. Which one of the following is **not** a valid logical argument?

A. $q \Rightarrow p, \neg q \Rightarrow r, \neg r \vdash p$

B. $r, p, p \Rightarrow (r \Rightarrow q) \vdash q$

C. $\neg p \Rightarrow \neg q, q \vdash p$

D. $p, r, (p \wedge q) \Rightarrow \neg r \vdash q$

23. If $f(x) = e^{(3x-1)}$, which of the following is equal to $f^{-1}(x)$?

A. $\frac{1}{e^{(3x-1)}}$

B. $\ln(3x-1)$

C. $3x-1$

D. None of these

24. Which one of the functions is one- to- one?

A. $f(x) = x^2$ on $(-\infty, \infty)$

B. $f(x) = x^2$ on $(-1, \infty)$

C. $f(x) = |x|$ on $(-1, \infty)$

D. $f(x) = |x-1|$ on $(1, \infty)$

25. Solve the equation $2\cos^2 x + 3\cos x + 1 = 0$ on the interval $x \in [0, 2\pi]$? (Angles are measured in radians.)

A. $\left\{\pi, \frac{3}{2}\pi\right\}$

B. $\left\{\frac{2}{3}\pi, \pi, \frac{4}{3}\pi\right\}$

C. $\left\{\frac{1}{3}\pi, \pi, \frac{2}{3}\pi\right\}$

D. None of these

26. What remainder do you get when we divide $x^{100} - 2x^{99} - x - 1$ by $(x+1)$?

A. -1

B. 2

C. 3

D. 4

27. Which one of the following is **true** about the graph of $f(x) = \frac{x^2-9}{x^2-2x-3}$?

A. $x = -1$ and $x = 3$ are its vertical asymptotes

B. $y = 0$ is its horizontal asymptote

C. $y = 1$ is its horizontal asymptote

D. $y = x - 3$ is its oblique asymptote

Top students

which exponential function has a graph that passes through the points $(2,-12)$ and $(4,-48)$?

A. $y = 3(2^x)$

B. $y = -\sqrt{3}(2^x)$

C. $y = \frac{4}{-3}(2^x)$

D. $y = -3(2^x)$

29. If $f(x) = 4x + 3$ and $f(x) - g(x) = -10x^2 + 8x + 6$, then $g(x)$ is

A. $10x^2 + 4x - 6$

B. $10x^2 - 4x - 3$

C. $5x^2 + 4x - 3$

D. $-10x^2 - 5x - 3$

30. What polynomial function has zeros: $1, 1+i$, and $1-i$?

A. $p(x) = x^3 - x^2 + 2x + 1$

B. $p(x) = x^3 - 4x^2 + 3x - 1$

C. $p(x) = x^3 - 4x^2 + 4x - 2$

D. $p(x) = x^3 + 2x^2 - 3x - 3$

Part II (Free response problems) Write your answer on the space provided

(2pts.each=10 marks)

1. A store selling calculators has found that when the calculators are sold at a price of p dollars per unit, the revenue R (in dollars) as a function of the price p is $R(p) = -750p^2 + 15000p$ What is the largest possible revenue? That is the maximum value of the revenue function

Answer: _____

2. The x-intercept of $y = \frac{k}{x+1} - 2$ is 0.5. What is the value of k?

Answer = _____

3. Find the **negation** of the proposition: $p \wedge (q \Rightarrow r)$. **Answer** _____

4. Let $f(x) = \frac{x}{2+x^2}$. Then

   a. Domain of f(Dom f)= _____

   b. Range of f (ran f)= _____

5. Solve for x : $4\log_4 x = 9\log_x 4$. **Answer** _____

Top students

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