

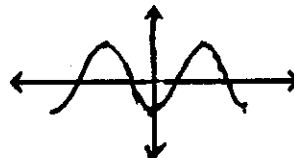
PRE-CALCULUS
FAMAT REGIONAL
MARCH 20, 1993

If none of the answers given is correct choose NOTA.

1. Find the value of k such that the line joining $(3,k)$ and $(-2,4)$ is perpendicular to the line $3x - y = 7$.

- a) -11 b) $7/3$ c) $17/3$ d) 19 e) NOTA

2. The equation of the following graph could be



- a) $y = 2\cos(x) - 2\sin(x)$ b) $y = -2\sin(x) + \cos(x)$
c) $y = -\sin(x) - 2\cos(x)$ d) $y = \sin(x) - 2\cos(x)$ e) NOTA

3. Simplify using the properties of Boolean Algebra. $a[abc + ab'c + a]'$

- a) 0 b) a c) a' d) 1 e) NOTA

4. How many points of intersection do $r = 4$ and $r = 6\cos(\theta)$ have?

- a) none b) one c) two d) three e) NOTA

5. Find the values of r for which the circle $x^2 + y^2 = r^2$ intersects the line $2x + y = 5$.

- a) $|r| \geq \sqrt{5}$ b) $r > \sqrt{5}$ c) $r \geq 5$ d) $|r| > 2\sqrt{5}$ e) NOTA

6. Find the coordinates of the foci of $9x^2 + 4y^2 - 72x - 24y + 144 = 0$.

- a) $(2 \pm \sqrt{5}, 3)$ b) $(4, 3 \pm \sqrt{5})$ c) $(4, 3 \pm \sqrt{13})$ d) $(2 \pm \sqrt{13}, 3)$ e) NOTA

7. Find the sum of the solutions of $2\cos^3(x) + \cos^2(x) - 5\cos(x) + 2 = 0$.
 $0 \leq x < 2\pi$

- a) $-1/2$ b) $\pi/3$ c) 2π d) 3π e) NOTA

8. If the infinite geometric series $x^2 - x^3 + x^4 - \dots$ converges to $x/6$, $x \neq 0$, what is the value of x ?

- a) $1/7$ b) $1/5$ c) $1/6$ d) 5 e) NOTA

9. Two cards are drawn from a bridge deck without replacement. Find the probability that both cards are of the same color.

- a) $25/102$ b) $1/4$ c) $50/101$ d) $1/2$ e) NOTA

10. The area of ΔPQR is 84. If $r = 14$ and $q = 15$, what are the two possible values of p ?

- a) 10.5 or 13 b) 10.5 or $\sqrt{673}$ c) 10.5 or $\sqrt{513}$
d) 13 or $\sqrt{673}$ e) NOTA

11. Find the equation of a plane normal to $v = 3i - 2j + k$ and containing the point $(-1, 4, 2)$.

- a) $3x + 2y + z = 7$ b) $3x - 2y + z = 9$ c) $3x - 2y + z = -9$
d) $-x + 4y + 2z = 15$ e) NOTA

12. The graph of $r = \frac{3}{1+\sin(\theta)}$ is a(n)

- a) line b) ellipse c) hyperbola d) parabola e) NOTA

13. Find the two trisection points of the line segment joining $(-3, -4)$ and $(6, 11)$.

- a) $(0, 1), (3, 6)$ b) $(1, -5/3), (4, 7/3)$ c) $(0, -1), (3, 6)$
d) $(3, 1), (1, 6)$ e) NOTA

14. Find the equations of all the asymptotes of $y = \frac{x^2+x-3}{x-1}$.

- a) $x=1, y=x$ b) $x=1, y=x+2$ c) $x=1, y=1$ d) $x=1, y=0$ e) NOTA

15. The current in Buccaneer Lake has a speed of 2km/h. Vinny can paddle his canoe 24km upstream and 24 km back to his starting point in the same number of hours as he can paddle 50 km in still water. What is Vinny's speed in still water?

- a) 10 b) $10\sqrt{2}$ c) 15 d) 20 e) NOTA

16. Find $f(g(h(3)))$ if $f(x) = x^2-1$, $g(x) = [x+1]$ and $h(x) = \sqrt{x+3}$.

- a) $2\sqrt{3}$ b) 3 c) 8 d) $6 + 2\sqrt{6}$ e) NOTA

17. Simplify $e^{2\ln(x)} - \ln(5) + \ln(3x)$.

- a) $\frac{x^3}{5}$ b) $\frac{3x^3}{5}$ c) $6x^2$ d) $75x^3$ e) NOTA

18. Randy is riding a racing bike at a speed of 50.4 km/hr. The wheels have a diameter of 70 cm. Find the angular velocity of the wheels in radians per second.

- a) 40 b) 65 c) 2400 d) 144,000 e) NOTA

19. Simplify $\left(\frac{i^{121}}{2+i}\right)^{-2}$.

- a) $\frac{1+2i}{5}$ b) $5-4i$ c) $-3+4i$ d) $\frac{-3-4i}{3}$ e) NOTA

20. Simplify $\frac{x^{-1} + 3y^{-1}}{x^{-2} + 4x^{-1}y + 3y^{-2}}$.

- a) $\frac{x^2y^2 + 3x^2y^2}{y^2 + 4xy^3 + 3x^2}$ b) $\frac{y^2 + 3x^2}{y^2 + 4xy + 3x^2}$ c) $\frac{xy^2 + 3x^2y}{y^2 + 4xy^3 + 3x^2}$
 d) $\frac{xy^2 + 3x^2y}{y^2 + 4xy + 3x^2}$ e) NOTA

21. What is the range of $y = |\text{Arctan}(x)|$?

- a) $0 < y < \pi/2$ b) $0 \leq y < \pi/2$ c) $y \geq 0$ d) $0 \leq y \leq \pi/2$ e) NOTA

22. Completely factor over the Complex Numbers. $x^5 + 3x^4 + 7x^3 + 13x^2 + 12x + 4$

- a) $(x-1)^3(x+2i)(x-2i)$ b) $(x-1)^3(x-2)(x+2)$
 c) $(x-2)^2(x-1)^2(x+1)$ d) $(x+1)^3(x-2i)(x+2i)$ e) NOTA

23. Find the cross product (vxw) if $v = i - 2j + k$ and $w = 2i + 3j - k$.

- a) $-i + 3j + 7k$ b) $i - 3j - 7k$ c) -5 d) $2\sqrt{21}$ e) NOTA

24. $A = \begin{bmatrix} 1 & 3 \\ -2 & 4 \end{bmatrix}$ $B = \begin{bmatrix} 2 & 4 \\ 1 & 0 \end{bmatrix}$ Find BA^2 .

- a) $\begin{bmatrix} 14 & 20 \\ -8 & 0 \end{bmatrix}$ b) $\begin{bmatrix} -50 & 70 \\ -5 & 15 \end{bmatrix}$ c) $\begin{bmatrix} 58 & -66 \\ -3 & 31 \end{bmatrix}$ d) $\begin{bmatrix} 25 & -12 \\ 0 & 64 \end{bmatrix}$ e) NOTA

25. Find xy if $\log(x^3y) = 3.7$ and $\log(x/y) = 2.1$.

- a) $10^{-.65}$ b) $10 \cdot 2$ c) $10 \cdot 45$ d) $10 \cdot 8$ e) NOTA

26. If the eccentricity of a conic is three it is a(n)

- a) circle b) parabola c) ellipse d) hyperbola e) NOTA

27. At a high school a four person faculty committee is chosen from 15 teachers and a principal. How many committees can be formed if the principal may not serve on the committee?

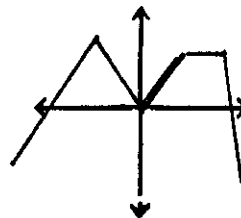
- a) 1365 b) 1820 c) 16380 d) 32760 e) NOTA

28. Which of the following statements are true for $n \in \text{Natural Numbers}$?

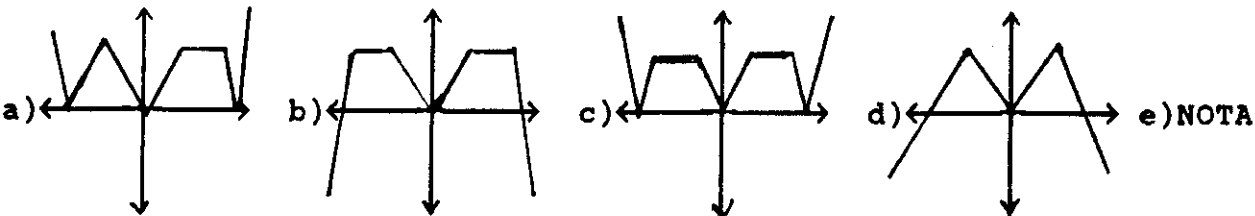
- I) $n^3 - n$ is divisible by 6.
 II) $(\cos(\theta) + i\sin(\theta))^n = \cos(n\theta) + i\sin(n\theta)$
 III) $2 < 2^n$
 IV) $\cos(n\pi) = (-1)^n$

- a) I, II, III only b) I, IV only c) I, II, IV only
 d) II, IV only e) NOTA

29. The graph of f is given over its entire domain.



Which could be the graph of $f|x|$?



30. Find the fifth term of $\left[\sqrt{2}x + \frac{1}{2} \right]^7$.

- a) $\frac{35\sqrt{2}x^3}{16}$ b) $\frac{35x^3}{8}$ c) $\frac{35x^4}{2}$ d) $\frac{21x^4}{16}$ e) NOTA