

Level 3 (Math Analysis) Blitz — 2008

- The solution set to the equation $|3x - 7| = 5$ is:
a. $\{4\}$ b. $\{4, -4\}$ c. $\{\frac{2}{3}, 4\}$ d. $\{4, \frac{-2}{3}\}$ e. none of these
- The period of the graph of the function $f(x) = -3\csc(2x - \frac{\pi}{8})$ is:
a. 2π b. $\frac{\pi}{2}$ c. $\frac{3\pi}{2}$ d. $\frac{\pi}{3}$ e. none of these
- $\sum_{j=0}^{\infty} \frac{3}{5^j} =$
a. ∞ b. $\frac{3}{4}$ c. $\frac{5}{2}$ d. $\frac{15}{4}$ e. none of these
- The range of the function $f(x) = -2x^2 + 12x - 13$ is:
a. $[5, \infty)$ b. $[-13, \infty)$ c. $(-\infty, 5]$
d. $(-\infty, -77]$ e. none of these
- Which of the following angles is coterminal with $\frac{-13\pi}{3}$?
a. 120° b. 600° c. -240° d. -60° e. none of these
- According to the Rational Zeros theorem which of the following is NOT a possible rational zero of the following polynomial function?
$$f(x) = 7x^4 - 3x^3 + x^2 - 5x - 10$$

a. $\frac{1}{7}$ b. $\frac{-1}{7}$ c. $\frac{7}{5}$ d. -2 e. none of these

Page 2

7. The exact value of $\csc(75^\circ) =$
- a. $\sqrt{6} - \sqrt{2}$ b. $\frac{4}{\sqrt{6} - \sqrt{2}}$ c. $\sqrt{2} + \sqrt{6}$
- d. $\frac{\sqrt{2} - \sqrt{6}}{4}$ e. none of these
8. How many solutions does the following system have?
- $$\begin{aligned} 2x - y + z &= 10 \\ -3x + 7y - 2z &= -4 \\ 16x - 19y + 9z &= 58 \end{aligned}$$
- a. none b. three c. one d. infinitely many
- e. none of these
9. In a certain triangle one angle measures 30° and the side opposite that angle measures 8.5 meters. Another side measures 18.1 meters. How many triangles satisfying these conditions can be formed?
- a. two b. one c. zero d. three
- e. none of these
10. If $\log(x) = a$ and $\log(y) = b$ then $\log\left(\frac{\sqrt[5]{x^3}}{\sqrt[8]{y^5}}\right) =$
- a. $\frac{25b - 24a}{40}$ b. $\frac{24a - 25b}{40}$ c. $\frac{25a - 24b}{15}$
- d. $\frac{28b - 25a}{15}$ e. none of these
11. Let M be a 2×2 matrix such that the determinant of M is 7. Then the determinant of the matrix $-3M^2$ is:
- a. -147 b. 441 c. -21 d. 63 e. none of these

Page 3

12. Which of the following is the equation of an asymptote of the graph of the function $y = \sec(2x)$?
- a. $x = \frac{\pi}{2}$ b. $x = \frac{-\pi}{4}$ c. $x = \frac{-\pi}{2}$
d. $x = \frac{3\pi}{2}$ e. none of these
13. The slope of any line perpendicular to the line described by the equation $-7y + 2x - 5 = 0$ is:
- a. $\frac{-1}{2}$ b. $\frac{7}{2}$ c. $\frac{-2}{7}$ d. $\frac{2}{7}$ e. none of these
14. If $\sin(t) = \frac{-3}{8}$ and $\pi < t < \frac{3\pi}{2}$ then $\tan(t) =$
- a. $\frac{\sqrt{55}}{3}$ b. $\frac{3}{\sqrt{55}}$ c. $\frac{-\sqrt{55}}{8}$ d. $\frac{-3}{\sqrt{55}}$ e. none of these
15. The eccentricity of the graph described by the equation $9x^2 + 16y^2 = 144$ is:
- a. $\frac{\sqrt{7}}{4}$ b. $\frac{5}{3}$ c. $\frac{4}{\sqrt{7}}$ d. $\frac{3}{4}$
e. none of these
16. $\log_{32}\left(\frac{1}{16^{\frac{2}{3}}}\right) =$
- a. $\frac{-2}{3}$ b. $\frac{8}{15}$ c. $\frac{-5}{6}$ d. $\frac{-8}{15}$ e. none of these
17. The graph of the polar function $r = \cos(2\theta)$ for $0 \leq \theta \leq 2\pi$ is symmetric about the:
- a. x -axis only b. y -axis only c. origin only
d. the x -axis, and the y -axis, and the origin e. none of these

Page 4

18. The domain of the function $f(x) = \sqrt{\frac{x}{x+5}}$ is:
- a. $(-\infty, -5)$ b. $[0, 5)$ c. $[0, \infty)$ d. $(-5, 0]$
- e. none of these
19. $125x^3 - 8 =$
- a. $(5x - 2)^3$ b. $(5x - 2)(25x + 4)$
- c. $(5x - 2)(25x^2 - 10x + 4)$ d. $(5x - 2)(25x^2 + 10x + 4)$
- e. none of these
20. The graph of the polar function $r = \frac{12}{5-4\cos(\theta)}$ for $0 \leq \theta \leq 2\pi$ is:
- a. a circle b. an ellipse c. an hyperbola d. a line
- e. none of these
21. The directrix of the graph of the polar function $r = \frac{12}{5-4\cos(\theta)}$ for $0 \leq \theta \leq 2\pi$ is:
- a. $x = \frac{1}{3}$ b. $y = \frac{1}{3}$ c. $x = -3$ d. $y = -3$
- e. none of these
22. If $\theta = \text{Arctan}\left(\frac{-12}{5}\right)$ then $\sin(\theta/2) =$
- a. $\frac{-12}{13}$ b. $\frac{-3}{\sqrt{13}}$ c. $\frac{2}{\sqrt{13}}$ d. $\frac{-2}{\sqrt{13}}$ e. none of these
23. The fifth term of the geometric sequence $12, -8, \dots$ is:
- a. $\frac{64}{27}$ b. $\frac{-96}{27}$ c. $\frac{-243}{4}$ d. $\frac{243}{4}$ e. none of these

Page 5

24. In the expansion of $(2x^2 - 3)^5$ the coefficient of x^4 is:
a. 1080 b. 10 c. -270 d. -540 e. none of these
25. One of the angles of a triangle measures 60° and the two adjacent sides measure seven meters and five meters. The length of the side opposite the 60° angle is:
a. $\sqrt{109}$ meters b. $\sqrt{39}$ meters c. $\sqrt{74}$ meters
d. $\sqrt{74 - 35\sqrt{3}}$ meters e. none of these
26. The focus of the graph of the parabola described by the equation $x = -8y^2 + 48y - 71$ is:
a. (1, 3) b. (3, 3) c. (-1, 3) d. (1, 1) e. none of these
27. $\sin(33^\circ)\cos(17^\circ) =$
a. $\frac{\sin(50^\circ) + \sin(16^\circ)}{2}$ b. $\frac{\sin(50^\circ) - \sin(16^\circ)}{2}$ c. $\frac{\cos(50^\circ) + \cos(16^\circ)}{2}$
d. $\frac{\cos(50^\circ) - \cos(16^\circ)}{2}$ e. none of these
28. If $\log_3(x) = y$ then $\log_9(x) =$
a. $2y$ b. $-y$ c. $y/2$ d. \sqrt{y} e. none of these
29. The inverse of the function $f(x) = \frac{2x-1}{4-x}$ is:
a. $\frac{4x-1}{x+2}$ b. $\frac{4-x}{2x-1}$ c. $\frac{4x+1}{2+x}$ d. $\frac{0.5x-1}{0.25-x}$ e. none of these

Page 6

30. $\tan(x + \frac{\pi}{4}) =$

- a. $\frac{2\tan(x) + \sec^2(x)}{1 - \tan^2(x)}$ b. $\frac{\tan(x) - 1}{1 + \tan(x)}$ c. $-\tan(x)$
d. $\tan(x) + 1$ e. none of these

31. The remainder when the polynomial $x^{17} - 5x^{13} + 8x^4 - 3$ is divided by $x + 1$ is:

- a. -9 b. -7 c. 1 d. 9 e. none of these

32. $\sin^2(-5x) =$

- a. $-\sin^2(5x)$ b. $\frac{1 + \cos(10x)}{2}$ c. $\frac{1 - \sin(10x)}{2}$
d. $\frac{1 - \cos(10x)}{2}$ e. none of these

33. Subtract: $\frac{7}{x^2 - x - 6} - \frac{5}{x^2 - 4} =$

- a. $\frac{2x + 1}{(x - 3)(x^2 - 4)}$ b. $\frac{2x - 29}{(x + 2)(x - 2)(x - 3)}$
c. $\frac{2x - 1}{(x^2 - x - 6)(x + 2)}$ d. $\frac{2x + 29}{(x^2 - x - 6)(x + 2)}$
e. none of these

34. How many solutions does the equation $\cos^2(3x) = 0.38$ have for $0 \leq x \leq 2\pi$?

- a. 6 b. 2 c. 12 d. 4 e. none of these

35. $\sum_{n=5}^{300} (7n - 15) =$

- a. 2085 b. 315,750 c. 311,550 d. 311,540
e. none of these

36. $\tan^{-1}(-\sqrt{3}) =$

- a. $\frac{5\pi}{3}$ b. $\frac{-\pi}{3}$ c. $\frac{6}{\pi}$ d. $\frac{-\pi}{6}$ e. none of these

37. Which of the following is an asymptote of the function

$$g(x) = \frac{3x^3 - 7x^2 + 17x - 34}{x^2 + 5} ?$$

- a. $y = 3$ b. $x = -5$ c. $y = 3x - 7$
 d. $y = 2x + 1$ e. none of these

38. The parametric equations $x = 3 - 4\sec(t)$ and $y = -2 + 5\tan(t)$ for $0 \leq t \leq 2\pi$ describe:

- a. a circle b. an hyperbola c. an ellipse
 d. a line e. none of these

39. The product of the two solutions to the equation $px^2 + qx + p = 0$ is:

- a. pq b. 1 c. $\frac{p^2}{q^2}$ d. -1 e. none of these

40. The real solutions of the equation $x^4 - 6x^3 + 6x^2 - 24x + 8 = 0$ are:
 (Hint: $x = 2i$ is a solution)

- a. $3 \pm \sqrt{7}$ b. $3 \pm 2\sqrt{7}$ c. $3 \pm \sqrt{11}$ d. $-3 \pm \sqrt{7}$ e. none of these

41. If $\theta = \text{Arcsin}(\frac{3x}{4})$ then $\sqrt{16 - 9x^2} =$

- a. $4 - 3x$ b. $\pm 4\cos(\theta)$ c. $4\sin(\theta)$ d. $\cos(4\theta)$
 e. none of these

Page 8

42. The determinant of the matrix $M = \begin{pmatrix} 2 & 1 & -3 \\ -2 & 4 & 3 \\ 5 & 2 & -1 \end{pmatrix}$ is:
- a. 65 b. 39 c. -39 d. -65 e. none of these
43. $-\ln|\csc(x) + \cot(x)| =$
- a. $\ln|\csc(x) - \cot(x)|$ b. $\ln|-\csc(x) - \cot(x)|$
c. $-\ln|\csc(x)| - \ln|\cot(x)|$ d. $\ln|\sin(x) + \tan(x)|$
e. none of these
44. The inverse of the matrix $\begin{pmatrix} 3 & -7 \\ 2 & 5 \end{pmatrix}$ is:
- a. $\begin{pmatrix} \frac{1}{3} & \frac{-1}{7} \\ \frac{1}{2} & \frac{1}{5} \end{pmatrix}$ b. $\begin{pmatrix} 5 & 7 \\ -2 & 3 \end{pmatrix}$ c. $\frac{1}{29} \begin{pmatrix} 3 & -7 \\ 2 & 5 \end{pmatrix}$
d. $\frac{1}{29} \begin{pmatrix} 5 & 7 \\ -2 & 3 \end{pmatrix}$ e. none of these
45. The area of the sector of a circle is 88 square meters. The length of the arc of the same sector is 22 meters. The measure of the central angle of the sector is:
- a. 8 radians b. 2.75 degrees c. 8 degrees
d. 2.75 radians e. none of these