



School of Aygoda
PRIMARY, SECONDARY & COLLEGE PREPARATORY
Academic Year 2012 E.C
Tel, 011-440-43-78/79

Full Name: _____ **Time Allowed: 3:00**

hrs.

Grade: 12 Section: _____ Subject: Mathematics 3rd Quarter Model

- Which one of the following function $f : \mathbb{R} \rightarrow [0, 2]$ is on to function?

A. $f(x) = x - [x]$ C. $f(x) = \operatorname{sgn} x + 2$

B. $f(x) = \frac{1x}{2} - 2 \left\lceil \frac{x}{4} \right\rceil$ D. $f(x) = x + [x]$
- Which of the following functions equal to its inverse function?

A. $f(x) = \frac{1}{x-1}, x \neq 1$ B. $f(x) = 3x - 3$ C. $f(x) = 2^x$ D. $f(x) = 1 - 2x$
- The seventh term of a_n if $a_1 = 2, a_2 = 3$ and $a_n = a_{n-1} + a_{n-2} + 2$ if $n \geq 3$ is

A. 35 B. 57 C. 19 D. 58
- What is the sum of the series $\sum_{n=1}^{\infty} (-4) \left(\frac{3}{5} \right)^{n-1}$?

A. -10 B. -4 C. $-\frac{13}{9}$ D. $-\frac{13}{10}$
- Which of the following is true about $\left\{ 2 + \frac{(-1)^n}{n+1} \right\}_{n=1}^{\infty}$

A. The least upper bound is $\frac{7}{3}$ C. The sequence is monotonic

B. The lower bound is $\frac{8}{5}$ D. $\frac{29}{15}$ is the term of the sequence
- To which of the following is $\frac{x^4-1}{|x+1|}$ equals to _____

A. 4 B. 0 C. 2 D. -2 E. -4
- Which one of the following is not correct?

A. $\lim_{x \rightarrow \infty} e^{\frac{1}{x}} = 1$ C. $e^{\frac{1}{x}} = \infty$

B. $\lim_{x \rightarrow 0} e^{\frac{1}{x}} = 0$ D. $\lim_{x \rightarrow \infty} e^{\frac{1}{x}} = 1$
- Which of the following statement is not correct bout the conic sections?

A. If the eccentricity of an ellipse close to 1 then the shape of the ellipse is elongated.

B. It is possible for parabola to intersect its directrix.

C. If the eccentricity of an ellipse close to 0 then the ellipse is circular.

D. The eccentricity of a hyperbola is always greater than 1.

9. Which one of the following is not correct about the graph of the function $f(x)$

$$= \frac{1}{x^2+1} ?$$

A. The x axis is the horizontal asymptote.

C. It has no vertical asymptote.

B. Its range is on the interval (0, 1]

D. None of the above

10. Which of the following is not True?

A. $\neg q \wedge P \equiv \neg(p \Rightarrow q)$

C. $\neg(p \wedge \neg q) \equiv \neg q \vee q$

B. $p \Rightarrow q \equiv \neg p \vee q$

D. All of the above

11. Which of the following pairs of line are asymptotes of the hyperbola $x^2 - 4y^2 - 2x = 1$?

A. $y = \frac{-1}{2}x + 1$ and $y = \frac{1}{2}x - 1$

C. $y = 2x + 1$ and $y = -2x - 3$

B. $y = 2x + 1$ and $y = -2x + 2$

D. $y = \frac{1}{2}(1-x)$ and $y = \frac{1}{2}(x-1)$

12. Water is poured in to cylindrical tanker of radius 5m at a rate of $10m^3/\text{min}$. What is the rate of change of the height of the level when it rises to 6?

A. $\frac{10}{25\pi} \text{ M/min}$

B. $\frac{10}{50\pi} \text{ M/min}$

C. $\frac{25\pi}{10} \text{ M/min}$

D. None of the above

13. Which one of the following limits exists?

A. $\lim_{x \rightarrow 0} \frac{x}{|x|}$

B. $\lim_{x \rightarrow 0} \frac{|x|}{x^2}$

C. $\lim_{x \rightarrow 0} \frac{x^2}{|x|}$

D.

$\lim_{x \rightarrow 0} \frac{|x|}{x}$

14. Let the universal set is the set of real number, then which one of the following is not True?

A. $(\forall x)(x^2+1 \geq 1)$

C. $(\forall x)(x^2+x+1 \geq 1)$

B. $(\exists x)(x^2+1 \leq 1)$

D. None of the above

15. What is the determinant of the matrix

$$A = \begin{pmatrix} -2 & 1 & 4 & 1 \\ 0 & 3 & -1 & 0 \\ 0 & 0 & 5 & 1 \\ 0 & 0 & 0 & -1 \end{pmatrix}$$

A. -8

B. 30

C. -30

D. 8

16. If $A = \begin{bmatrix} 0 & 1 & 2 \\ 3 & -1 & 0 \\ 5 & 2 & 4 \end{bmatrix}$ and $B^T A = 2I$, where B is 3 x 3 matrix and I is the identity

matrix of order 3

then what is the $\det(B)$?

A. $\frac{1}{5}$

B. $\frac{4}{17}$

C. $\frac{4}{5}$

D. $\frac{1}{17}$

17. The total cost for ordering and storing x units is given by $c(x) = 3x + \frac{30,000}{x}$

Birr. How many units

must be ordered to produce a minimum cost?

- A. 300 B. 50 C. 100 D. 1000

18. On which of the following intervals is the graph of $f(x) = \ln(x^2 + 1)$ concave upward?

- A. $[-1, 1]$ B. $(-\infty, -1) \cup (1, \infty)$ C. $(-\infty, 0]$ D. $[0, \infty)$

19. Which of the following is equal to $\int_0^{\frac{\pi}{3}} \frac{\tan x}{\cos x} dx$?

- A. $\frac{1}{2}$ B. 1 C. $-\frac{1}{2}$ D. $-\frac{1}{2} + \frac{2\sqrt{3}}{3}$

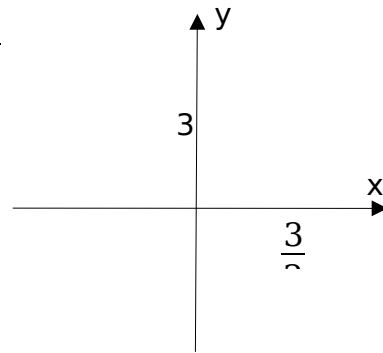
20. Which one of the following is correct about the graph of given below

A. It is the graph of the function $f(x) = \frac{2x-3}{x^2+1}$

B. It has no vertical asymptote.

C. Its horizontal asymptote is the line $y = 0$

D. All of the above.



21. The asymptote of the hyperbola $xy = 8$ is _____?

- A. $y = 4$ B. $x = -4$ C. $x = 0$ D. $y = -2$

22. Suppose $e(x) \equiv x$ is even; $p(x) \equiv x$ is prime $d(x) \equiv x$ is divisible by 2. Which one of the following

has the truth value F(false) on the set of natural numbers?

- A. $(\exists x) [e(x) \wedge p(x)]$ C. $(\exists x) [e(x) \wedge \neg d(x)]$
B. $(\forall x) [e(x) \implies d(x)]$ D. $(\forall x) [e(x) \vee d(x)]$

23. In the set of complex number, the solution set of $x^2 - 2x + 5 = 0$ is

- A. $\emptyset$ B. $[2+1, 2-i]$ C. $[1+i, 1-2i]$ D. $[2+4i, 2-4i]$

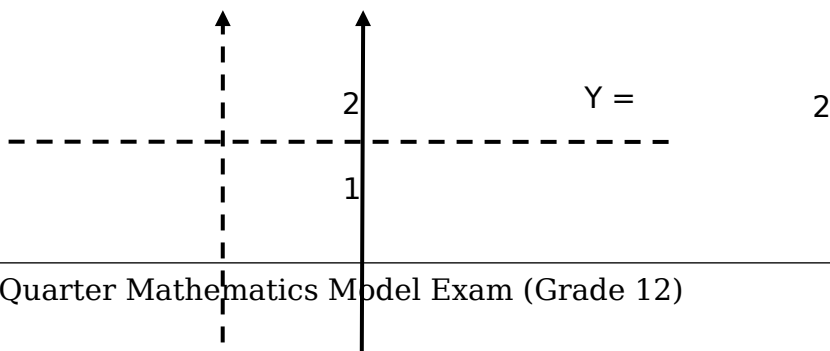
24. $\lim_{x \rightarrow \infty} \left(1 + \frac{1}{x}\right)^{2x+4}$ is equal to

- A. e B. e^2 C. e^4 D. ∞

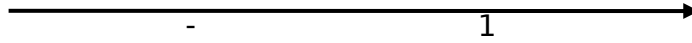
25. Which of the following functions could most likely be sketched as in the figure below?

A. $f(x) = \frac{2x}{x+1}$

B. $f(x) = \frac{2x^2-2x}{x^2+1}$



C. $f(x) = \frac{2}{x+1}$



D. $f(x) = \frac{2x^2}{x^2-1}$

$x = -$

26. $\lim \left\{ \frac{1+4+7+\dots+3n-2}{5-2n^2} \right\}$ is equal to

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

B. $\frac{3}{10}$

C. $\frac{-3}{4}$

D. $\frac{3}{4}$

27. $\lim_{x \rightarrow \pi} \frac{x \sin 2x}{x - \pi}$ is equal to _____

A. 2π

B. π

C. 0

D. 1

28. Let $f(x) = \begin{cases} a - \cos x, & x \leq 0 \\ 3e^x - a, & x > 0 \end{cases}$ for what value of "a" is continuous function

A. 1

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

C. 2

D. 3

29. Let $f(x) = x^2 \sqrt{2x+12}$, then equation of tangent line to the graph of $f(x)$ at $x = 2$

A. $y - 4 = 16(x - 2)$

C. $y = \frac{1}{\sqrt{12}}(x - 2) - 16$

B. $y = 17(x - 2) + 16$

D. It has no tangent line at $x = 2$

30. What are the value of a and b if $f(x) = ax^3 + bx^4$ has minimum value at (1, 1)

A. $a = 3, b = 4$

B. $a = 4, b = -3$

C. $a = -4, b = 3$

D. $a = 3, b = -4$

31. A rectangular page contained 24 square inches of print. The margins at the top and bottom of the

page are to be $1\frac{1}{2}$ inch and margins on the left and the right to be 1 inches.

What dimensions of the page will produce the smallest area in inches?

A. 6 by 4

B. 8 by 6

C. 9 by 6

D. 10 by 8

32. Which of the following is the focus of the parabola whose equation is $y^2 + 8x + 6y + 25 = 0$?

A. $(-2, -3)$

B. $(3, 2)$

C. $(-4, -3)$

D. $(0, -2)$

33. $\lim_{n \rightarrow \infty} \frac{2n^2 - n + 1}{6n^2 + 1}$ is equal to _____

A. 2

B. $\frac{1}{3}$

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

D. ∞

34. Which of the following is the equation of the circle with center $(2, -1)$ and tangent to the y - axis?

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

C. $(x-2)^2 + (y+1)^2 = 4$

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

$$D. (x+2)^2 + (y+1)^2 = 4$$

35. Let $p(x) : x^2 + y$ is positive which of the following is equivalent to $\neg (\exists x) p(x)$

$$A. (yx) \neg (x^2 + x > 0)$$

$$C. (\exists x) \neg (x^2 + x \leq 0)$$

$$B. (\forall x) (x^2 + x < 0)$$

$$D. (\forall x) (x^2 + x \leq 0)$$

36. Let $f(x) = \begin{cases} 3a-x, & \text{if } x < 1 \\ b+1 & \text{if } x = 1 \\ ax, & \text{if } x > 1 \end{cases}$

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

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

$$C. -1$$

$$D. 3$$

37. $\int (2 + \sin^2 x) \cot x dx$ is equal to _____

$$A. 2 \csc x - 2 \sec 2x + c$$

$$C. 2 \ln |\sin y| + \cos 2x + c$$

$$B. 2 \ln |\sin x| + \frac{1}{2} \sin 2x + c$$

$$D. 2 \csc x + \sin x \cos x + c$$

38. A committee consisting of 3 students is to be selected from 10 candidates among which 4 are girls.

What is the probability that at least one girl is selected?

$$A. \frac{5}{6}$$

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

$$C. \frac{1}{3}$$

$$D. \frac{1}{6}$$

39. The mark that students scored in an examination is grouped in class interval as shown in the following table

Class interval (mark)	Number of students
56–64	8
65–74	12
75–84	20
85–94	6
95–100	4

What is the median of the mark?

$$A. 25.0$$

$$B. 77.0$$

$$C. 75.5$$

$$D. 79.5$$

40. If $Z = \cos \left(\frac{\pi}{10} \right) + i \sin \left(\frac{\pi}{10} \right)$, then what is the value of Z^5 ?

$$A. \frac{\pi}{2} + \frac{\pi}{2}i$$

$$B. \frac{1}{2} + \frac{1}{2}i$$

$$C. I$$

$$D. 1 + i$$

41. A ball is thrown vertically from the ground up to a height of 16m. Each time it drops h meters, it rebounds 0.80m. Nothing that the ball travels every height of h twice, what

is the total vertical

distance traveled by the ball?

- A. 40m B. 80m C. 160m D. 320m

42. What is the value of $\int \frac{x}{(x^2+1)^2} dx$

- A. $\frac{1}{4}$ B. $\frac{1}{2}$ C. 1 D. $-\frac{1}{4}$

43. Suppose a geometric sequence has terms $G_{10}=192 \wedge G_6=12$ which of the following is equal to G_2

- A. $\frac{3}{2}$ B. $\frac{3}{4}$ C. $\frac{3}{8}$ D. $\frac{3}{16}$

44. $\int \frac{x^{2x}-4x}{xe^{2x}} dx$ is equal to _____

- A. $\ln|x|+2e^{-2x}+c$ C. $\ln|x|-4e^{2x}+c$
B. $4e^{2x}-3\cos x$ D. $4e^{2x}+3\cos x$

45. If $f(x)=e^{2x}+x-3\cos(x)$, then what is $f''(x)$?

- A. $e^{2x}+1-3\sin x$ C. $4e^{2x}-3x\cos x$
B. $e^{2x}+1+3\sin x$ C. 4 D. $4e^{2x}+3\cos x$

46. If $x^2-6x+y^2+k=0$ is equation of a circle with radius 2, then what is the value of k?

- A. 13 B. 5 C. 4 D. -4

47. If $g(x) = xf(x) - \sqrt{f(x)}$, and $f(2) = f'(2) = 4$ then which of the following is equal to $g'(2)$?

- A. 11 B. 8 C. 2 D. 0

48. If $y=\sin(3x^2)$, then the simplified form of $\frac{d^2y}{dx^2}$ is

- A. $-6\sin(3x)2$ C. $6\cos(3x^2)-36x^2\sin(3x^2)$
B. $\cos(6x)-6\sin(3x)2$ D. $x^2\cos(3x^2)+6\sin(3x^2)$

49. What is the area of the region between the graphs of $y = x^2$, $y = -x + 2$ where $0 \leq x \leq 2$?

- A. 3 B. 2 C. $\frac{3}{2}$ D. $\frac{2}{3}$

50. If a box with square base open top is made from 1200cm^2 material, what is the largest volume of the box in cm^3 ?
- A. 4000 B. 8000 C. 15000 D. 3000

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51. Line l passes through $(0, 5)$ and $(-5, 0)$. What is the angle between the y -axis and l in radian measure?

- A. $\frac{\pi}{3}$ B. $\frac{\pi}{4}$ C. $\frac{\pi}{2}$ D. $\frac{3}{4}\pi$

52. Which of the following is a vector equation of the line tangent of the circle $x^2 + y^2 + 2x - 7 = 0$ at $(1, 2)$

- A. $y = 2x + 1$ B. $y = x - 1$ C. $y = -2x + 1$ D. None of the above

53. Let l be the line whose equation is $2x - y = 10$. Which one of the following is the equation of the image of l after a reflection in the line $y = 2x + 5$ followed by a rotation through the angle of 90° about the origin

- A. $x + 2y = 0$ B. $2x + y = 0$ C. $x + 2y = 5$ D. $x - 2y = 5$

54. Suppose $\vec{A} = 2\vec{i} - \vec{j} + 2\vec{k}$ and $\vec{B}$ is a vector in space such that $|\vec{B}| = |\vec{A}|$. If $\vec{U}$ is the unit vector in

the direction of $\vec{B}$ then $|\vec{A} + \vec{U}|$ is equal to _____

- A. 16 B. 12 C. 10 D. 14

55. If l is the line passing through $(0, 2)$ and parallel to $\vec{V} = \vec{i} + 3\vec{j}$, which one of the following is true

about l and the circle $(x-2)^2 + (y-1)^2 = 5$

- A. l is tangent to the circle at $(0, 2)$

B. l is tangent to the circle at some points P. Where $p \neq (0, 2)$

C. Intersects the circle at two distinct points

D. The distance between l and the center of the circle is greater than $\sqrt{5}$

56. If a translation take the circle $x^2+y^2-2x+6y+3=0$ into the circle whose equation is

$(x+2)^2+(y-4)^2 = 7$, then what is the image of the origin under T?

A. $(-3, 7)$

B. $(1, 2)$

C. $(1, -3)$

D. $(-2, 4)$

57. What is $\cot(\arcsin x)$, if $0 < x < 1$?

A. $\frac{x}{\sqrt{1-x^2}}$

B. $\frac{\sqrt{1-x^2}}{x}$

C. $\sqrt{1-x^2}$

D. $\frac{1}{1-x^2}$

58. What is the possible value of x that solves equation $\sin^{-1} x + \cos^{-1}\left(\frac{3}{5}\right) = \pi$?

A. $\frac{\pi}{3}$

B. $\frac{3}{5}$

C. $\frac{5\pi}{2}$

D. $\frac{4}{5}$

59. What is the amplitude and period, respectively, of the graph of $f(x) = 4\sin\left(\frac{x}{3}\right)\cos\left(\frac{x}{3}\right)$

A. $\frac{\pi}{3}$

B. $2, 3\pi$

C. $2, \frac{2\pi}{3}$

D. $4, 3\pi$

60. Let $\vec{a} = -\hat{i} + 3\hat{k}$ and $\vec{b} = -\hat{i} + \hat{j}$ be vectors in space which one of the following cosine of the angle between $\vec{a}$ and $\vec{a} - \vec{b}$?

A. $\frac{9}{10}$

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

C. $\frac{3}{\sqrt{10}}$

D. $\frac{-9}{10}$

61. Suppose P and Q are points in space such the midpoint of $\overline{PQ}$ is on the negative Z-axis and the distance between P and Q is 6. If $P = (2, -1, 0)$, then what is the coordinate of Q?

A. $(-2, 1, 4)$

B. $(2, -1, 6)$

C. $(2, -1, -6)$

D. $(-2, 1, -4)$

62. What is the contra positive of "If $x \in \mathbb{N}$, then x is integer $x < 0$ "?

A. If x is not integer or $x < 0$, then $x \in \mathbb{N}$

C. If x is not integer or x

≤ 0 , then $x \in \mathbb{N}$

B. If x is integer and $x > 0$, then $x \in \mathbb{N}$ and $x \leq 0$

D. If $x \in \mathbb{N}$, then x is not integer

63. Which one of the following is valid assertion that can be proved by the principle of mathematical induction?

A. $2^n > n$ for every integer n such that $n \geq 6$

B. $r^2 > 0$ for every real number r such that $r \geq 1$

C. $n^2 \geq 10n > 2n^2$ for every natural number $n \geq 1$

D. $2^n > 8n$ for every n such that $n \geq 3$

64. The valid conclusion from the premises $P \vee Q$, $Q \implies R$, $P \implies M$, $\neg M$ is

A. $P \wedge (R \vee M)$ B. $Q \wedge (P \wedge R)$ C. $P \wedge (P \wedge R)$ D. $R \wedge (P \vee Q)$

65. Suppose that the equation $x^2 + y^2 + z^2 + 2x + 8z = 6(y + 1)$ represents a sphere.

What is the

point $(1, -1, 4)$ located relative to the sphere?

A. Inside the sphere

C. At the center of the sphere

B. On the sphere

D. Outside the sphere