

For Grade 12

Date March 2020

Time allowed: 3:00 hrs

CHOOSE THE CORRECT ANSWER FORM GIVEN CHOICE

1. It K^{th} term of the sequence is $a_k = \frac{(-1)^k(2-k)}{2k-1}$ then the next term a_{k+1} when k is even is _____

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

2. The sum of the series $\sum \frac{(-1)^n}{(3^n)^2}$ is equal to

A. $\frac{-1}{10}$ B. $\frac{9}{10}$ C. $\frac{9}{8}$ D. $\frac{-9}{10}$

3. If a geometric progression $G_2 = -10$ & $G_4 = \frac{-8}{5}$ and $G_5 > 0$, then the general term G_n is

A. $25\left(\frac{2}{5}\right)^{n-1}$ B. $25\left(\frac{-2}{5}\right)^{n-1}$ C. $\frac{2^{n-1}}{(-5)^{n-2}}$ D. $25\left(\frac{-2}{5}\right)^n$

4. Which of the following is in an arithmetic progression?

A. 2, 4, 8, 16
B. 1, -9, -19, -29
C. -81, 27, -9, 3, ...
D. 9, -3, 1, -1/3

5. A ball is dropped from a height of 9m it rebounds 80% of the distance after each fall then the total distance the ball travels before it comes to rest is _____

A. 9m B. 81m C. 36m D. 18m

6. The sum of multiples of 4 between 12 and 98 inclusively is

A. 1196 B. 1127 C. 1242 D. 1188

7. The $\lim_{x \rightarrow 1} \frac{x^2+x-2}{x^2-x}$ is equal to

- A. -2 B. 3 C. 1 D. doesn't exist

8. The $\lim_{x \rightarrow 0} \frac{xe^x - xe^x}{x} =$ _____

- A. 0 B. -2 C. -1 D. #

9. What is the value of k so that $f(x) = \begin{cases} 3x+4 & x \leq 2 \\ kx-5 & x > 2 \end{cases}$ is continuous everywhere?

- A. 10 B. $\frac{5}{7}$ C. $-\frac{15}{4}$ D. $\frac{5}{2}$

10. The value of the $\lim_{x \rightarrow \pi} \sin x$ is

- A. 2π B. π C. 0 D. 1

11. $\lim_{x \rightarrow \infty} \left(\frac{x+a}{x-3a} \right)^{5x} = 4$, the value of a = _____

- A. $\frac{1}{10}$ B. $\frac{1}{20} \ln 4$ C. $\ln \left(\frac{2}{10} \right)$ D. $\frac{2}{11}$

12. If $f(x) = \ln 2x$ then $\lim_{x \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ is equal to

- A. 0 B. $\frac{1}{x}$ C. $-\frac{x}{2}$ D. $-\frac{x}{x}$

13. If $f(5) = 15$, $f'(5) = 3$ then $\lim_{x \rightarrow 5} \frac{xf(5) - 5f'(x)}{x-5}$ is

- A. 15 B. 0 C. 3 D. 4

14. If $g(x) = \frac{f(x)}{x+2} + 4f(x)$, $f(2) = 8$, $f'(2) = 4$ then $g'(2)$ is equal to

- A. $\frac{35}{2}$ B. $\frac{3}{2}$ C. $\frac{2}{3}$ D. $\frac{33}{2}$

15. If $Y = (\ln(3x))^3$ then $\frac{d^2Y}{dx^2} =$ _____

- A. $\frac{6 \ln x - 3 \ln(3x)}{x^2}$ C. $\frac{3 \ln x - 6(\ln 3x)^2}{x^2}$

B. $\frac{3\ln(3x)x^2}{x}$

D. $3\ln 3x(2-\ln x)$

16. Given $x^2y+xy=20$, the rate of change of x with respect to y or $\left(\frac{dx}{dy}\right)$ is equal to

A. $\frac{2xy+y}{x^2+x}$

B. $\frac{-x^2-x}{2xy+y}$

C. $\frac{x^2+y}{2xy}$

D. $\frac{-x^2+x}{y+x}$

17. The value of C that satisfy the mean value theorem for the function $f(x)=2x^2+3x+1$ on $[1, 2]$ is

A. 2

B. $\frac{5}{2}$

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

D. $\frac{7}{2}$

18. The area of the circle is increasing uniformly at the rate of 12π cm²/sec. Which of the following is the rate of change of radius of the circle is $r = 3$ cm?

A. 3cm/sec

C. 5cm/sec

B. 2cm/sec

D. 6cm/sec

19. If $f(x)=\frac{x^3}{4}-3x$ then which of the following is not true about $f(x)$?

A. f is strictly increasing on $(-\infty, -2) \wedge (2, \infty)$ is not true about $f(x)$

B. f is strictly decreasing on $[-2, 2]$

C. $f(x)$ changes sign from negative to positive at $x=-2$ and positive to negative at $x=2$

D. $f(-2)=4$ is the relative maximum value

20. Which of the following is not true?

A. If $f(x)$ is the n^{th} degree polynomial then $f^{(n)}$

B. If $h(x)=f(x).g(x)$ then $h^1(x)=f^1(x)g^1(x)$

C. If $f(x)=x(x+1)(x+2)(x+4)$ then $f^{(4)}(x) = 24$

D. If $f^1(c)$ and $g^1(c)$ are zero & $h(x) = f(x).g(x)$ then $h^1(c) = 0$

21. The antiderivative of $f(x)=\frac{1}{1+e^{-x}}$ is

A. e^{-x}

B. $\ln(1+e^{-x})$

C. $\ln(1+e^x)$

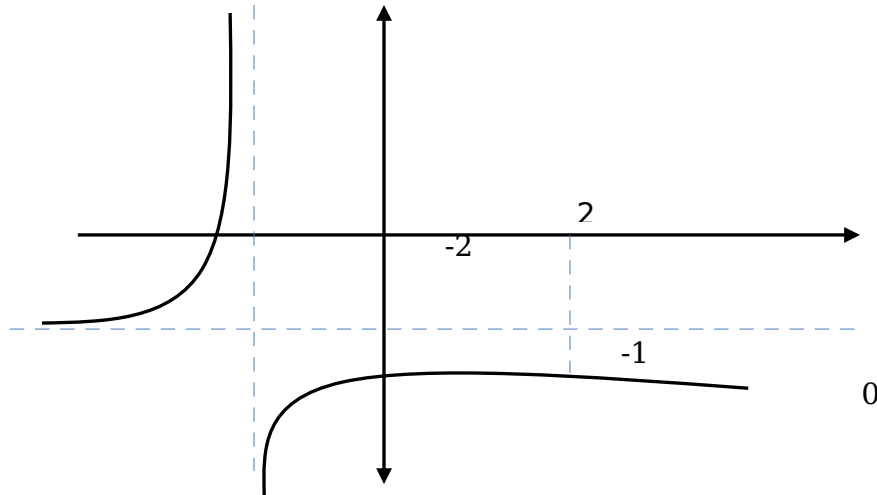
D. $1+e^{-x}$

- C. $\frac{2}{5}(1-x)^{2/5} - \frac{2}{3}(1-x)^{3/2} + C$
- D. $\frac{1}{2}$
29. The points on the graph of the function $f(x) = x^2 - 4$ that are closest to the point $Q(0, 2)$ is
- A. $(0, -4)$ B. $(-\sqrt{\frac{11}{2}}, \frac{3}{2})$ C. $(\sqrt{\frac{1}{2}}, -\frac{7}{2})$ D. $(1, -3)$
30. Let $W = \frac{8i}{1+i} + \frac{(1-3i)^2}{2}$, then $|W|$ is equal to
- A. 1 B. 2 C. $\sqrt{2}$ D. $\frac{1}{2}$
31. If $Z = x + yi$ is a complex number, then $2|Z|^2 + (Z - \bar{Z})^2 = 2$ is equivalent to which one of the following equations?
- A. $x^2 - y^2 = 2$ C. $x^2 - y^2 = 1$
 B. $2x^2 - y^2 = 1$ D. $x^2 - 3iy^2 = 1$
32. Which one of the following ordered pairs belong to R^{-1} if $R = \{(x, y) : y \geq x^2 + x + 1 \wedge y \leq 5 - 2x\}$
- A. $(7, -1/2)$ B. $(1, -5)$ C. $(8, 0)$ D. $(5/4, -1/2)$
33. Which one of the following is False?
- A. The graph of $f(x) = \frac{x^3 - x}{x^2 - x}$ has no vertical asymptote
- B. The inequality $\frac{1}{x} - \frac{2x+1}{x^2} > 1$ has no solution
- C. $(4, \frac{1}{2})$ is an element of the graph of $f(x) = \frac{x-4}{x^2 - 6x + 8}$
- D. If $h(x) = \frac{x}{x^2 + x - 2}$, then $h(x) \rightarrow -\infty$ as $x \rightarrow 2$
34. Which one of the following is True about the graph of $f(x) = \frac{4x^2 - 1}{x - 2x^2}$?
- A. $(-\frac{1}{2}, 0) \wedge (\frac{1}{2}, 0)$ are its x-intercepts
- B. $y = 2$ is its horizontal asymptote

C. $y = -2x - 1$ is its oblique asymptote

D. $y = -2$ is almost the same as the line $y = -2$ as $x \rightarrow \pm \infty$

35. Which of the following functions could most likely be drawn as in the figure shown below?



A. $\frac{x^2 - x - 6}{4 - x^2}$

C. $\frac{x^2 - 2x}{4 - x^2}$

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

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

36. What is the principal argument of $(-3 - 3i)^{1/3}$?

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

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

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

D.

$\frac{3\pi}{4}$

37. If $f(x) = \sqrt[3]{1 + e^{-2x}}$, which of the following is equal to $f^{-1}(x)$?

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

C. $\ln(1 + e^{-2x})^3$

B. $\ln \frac{1}{\sqrt{x^3 - 1}}$

D. $\ln(1 + x^3)$

38. If $(p \vee q) \Rightarrow (7r \wedge r)$ is True, then which one of the following is necessarily True?

A. $(p \vee r) \Rightarrow q$

C. $\neg p \Rightarrow r$

B. $\neg q \wedge r$

D. $\neg p \vee r$

39. Which of the following is False?

A. $\begin{vmatrix} 4-2 \\ 1-3 \end{vmatrix} = -10$

C. the inverse of $\begin{pmatrix} 3 & 5 \\ 1 & 2 \end{pmatrix}$ is $\begin{pmatrix} 2 & -5 \\ -1 & 3 \end{pmatrix}$

B. $\begin{vmatrix} 2-10 \\ 0 & 3-2 \\ 1 & 0 & 1 \end{vmatrix} = 8$

D. the inverse of $\begin{pmatrix} 2 & -3 \\ 4 & -7 \end{pmatrix}$ is $\begin{pmatrix} -3.5 & 11.5 \\ 2 & -1 \end{pmatrix}$

40. An urn contains 6 marbles and 4 black marbles. Two marbles are drawn without replacement from the urn. What is the probability that both of the marbles are black?

A. $2/5$

B. $1/3$

C. $2/15$

D. $1/90$

41. A student goes to the library. The probability that she checks out (a) a work of fiction is 0.40, (b) a work of non-fiction is 0.30, and (c) both fiction and non-fiction is 0.20. What is the probability that the student checks out a work of fiction, non-fiction, or both?

A. 0.70

B. 0.50

C. 0.35

D. 0.10

42. Seven students estimated the length of a book to the nearest cm. in order their estimates were: 25cm, 28cm, 30cm, 31cm, 32cm, 34cm and 37cm. Which one of the following is not true?

A. Median = 31cm

C. upper quartile = 34cm

B. Lower quartile = 28cm

D. range = 6cm

43. The mode of the grouped data given below is

Time to travel to work	Frequency
1 - 10	8
11 - 20	14
21 - 30	12
31 - 40	9
41 - 50	7

A. 14.5

B. 17.5

C. 20.6

D. 21.2

44. A searchlight has a parabolic reflector (has a cross section that forms a "bowl"). The parabolic "bowl" is 16 inches wide from rim to rim and 12 inches deep. The filament of the light is located at the focus. How far from the vertex is the filament for the light bulb?

- A. $\frac{4}{3}$ inch
B. $\frac{3}{16}$ inch

- C. $\frac{3}{4}$ inch
D. $\frac{1}{75}$ inch

45. The equation of the line tangent to the circle $(x - 3)^2 + (y + 2)^2 = 61$ at the point $(-2, -8)$ is given by
- A. $y = \frac{-5}{6}x - \frac{29}{3}$ C. $y = \frac{-6}{5}x - 1$
B. $y = \frac{-6}{5}x - \frac{29}{3}$ D. $y = \frac{-5}{6}x + 1$
46. If the lines $y = \frac{4}{3}x - \frac{5}{3}$ and $y = \frac{-4}{3}x - \frac{13}{3}$ each contain diameters of a circle, and the point $(-5, 0)$ is also on that circle, then the equation of the circle is given by
- A. $(x + 1)^2 + (y + 3)^2 = 5$
B. $(x + 1)^2 + (y + 3)^2 = 3$
C. $(x + 1)^2 + (y + 3)^2 = 25$
D. $(x + 1)^2 + (y + 3)^2 = 9$
47. Which one of the following is not true about the conic section with equation $x^2 - 4x - 8y + 28 = 0$?
- A. Vertex = $(2, 3)$ C. Axis: $x = 2$
B. Focus = $(2, 5)$ D. Directrix: $y = -1$
48. The eccentricity of the conic section with equation $\frac{x^2}{9} - \frac{y^2}{16} = 1$ is
- A. $\frac{3}{4}$ B. $\frac{4}{5}$ C. $\frac{5}{3}$ D. $\frac{3}{5}$
49. Which of the following statements is not true for the graph of $3x^2 - 4y^2 = 24$?
- A. One focus is at $(0, \sqrt{14})$
B. The length of conjugate axis is $2\sqrt{6}$
C. The graph goes through $(-2\sqrt{2}, 0)$
D. The transverse axis has length $2\sqrt{8}$
50. Two girls are standing in a whispering gallery that is shaped like semi-elliptical arch. The height of the arch is 30 feet, and the width is 100 feet. How far from the center of the room should whispering dishes be placed so that the girls can whisper to each other?
- A. 30 feet C. 50 feet

56. Suppose $\vec{A} = 3\vec{i} - 4\vec{j}$ and $\vec{B}$ is a vector in the xy -plane such that the angle between $\vec{A}$ and $\vec{B}$ then $\vec{A} \cdot (\vec{A} - 2\vec{B})$ is equal to
 A. 30 B. 20 C. 15 D. 5
57. 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 at $(0, 2)$
 A. l is tangent to the circle at $(0, 2)$
 B. l is tangent to the circle at some point p , where $p \neq (0, 2)$
 C. l intersects the circle at two distinct points
 D. The distance between l and the center of the circle is greater than $\sqrt{5}$
58. Which one of the following is not true?
 A. $\cos^{-1}\left(\sin \frac{\pi}{8}\right) = \frac{3\pi}{8}$ C. $\cos\left(\sin^{-1}\left(\frac{1}{3}\right)\right) = \frac{2\sqrt{2}}{3}$
 B. $\sin\left(\cos^{-1}\left(\frac{-3}{4}\right)\right) = \frac{\sqrt{7}}{4}$ D. $\tan\left(\sin^{-1}\left(\frac{3}{4}\right)\right) = \frac{3}{\sqrt{7}}$
59. If $\vec{A} \cdot \vec{B} = 2$, $|\vec{A}| \neq |\vec{B}| = 2$ for two vectors $\vec{A}$ and $\vec{B}$, then the angle between $\vec{A}$ and $\vec{B}$ is
 A. 90° B. 60° C. 45°
 D. 00°
60. Which one of the following is not true?
 A. $\sin(\tan^{-1} x) = \frac{x}{\sqrt{1+x^2}}$
 B. $\cot(\tan^{-1} x) = \frac{1}{x}$
 C. $\sec(\tan^{-1} x) = \sqrt{1+x^2}$
 D. $\tan(\tan^{-1} x) = 1 - x$
61. if $\vec{a} = -2\vec{i} + 4\vec{j}$, $\vec{b} = -6\vec{i} + 2\vec{j}$ and $\vec{c} = -6\vec{j}$, are vectors in $\mathbb{R}^2$, then what is the cosine of the angle between $\vec{a} + \vec{c}$ and $\vec{b}$
 A. $\frac{\sqrt{8}}{8}$ B. $\frac{\sqrt{10}}{10}$ C. $\frac{\sqrt{5}}{5}$ D. $\frac{\sqrt{2}}{2}$
62. Suppose $\vec{a}$ is a unit vector and $\vec{b}$ is a vector such that $|\vec{a} + \vec{b}| = 8$ and $|\vec{a} - \vec{b}| = 6$, the $|\vec{b}|$ is equal to
 A. 8 B. 7 C. 6 D. 5

63. What is the image of the point $\left(-\frac{1}{3}, \frac{1}{2}\right)$ when it is reflected in the line $y = 3x - 2$

A. (1.9, -0.3)

C. (2.1, -1.2)

B. $(-\frac{1}{3}, 1)$

D. (2.4, -2.2)

64. If $\frac{3}{2}\pi < \theta < 2\pi$, $\wedge \cos \theta = \frac{5}{13}$, then $\cos \frac{\theta}{2}$ is equal to

A. $\frac{-3}{\sqrt{13}}$

B. $\frac{2}{\sqrt{13}}$

C. $\frac{-2}{\sqrt{13}}$

D. $\frac{3}{\sqrt{13}}$

65. Under the set of complex numbers, what will be the solution set of the equation $x^2 - 2x + 5 = 0$?

A. $\{\}$

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

C. $[1+2i, 1-2i]$

D.

$[2+4i, 2-4i]$

66. The polar form of the complex number $z = 1 - \sqrt{3}i$ is:

A. $2\left(\cos \frac{5\pi}{3} + i \sin \frac{5\pi}{3}\right)$

C. $2\left(\cos \frac{\pi}{6} + i \sin \frac{\pi}{6}\right)$

B. $2\left(\cos \frac{\pi}{6} - i \sin \frac{\pi}{6}\right)$

D. $2\left(\cos \frac{5\pi}{3} - i \sin \frac{5\pi}{3}\right)$

67. The value of x so that $|x - x + 4i| = 2$

A. $\begin{vmatrix} 0 & x & x \\ 1 & -2 & 3 \end{vmatrix}$

68. For what value of x and y a matrix $\begin{vmatrix} 0 & x & x \\ 1 & -2 & 3 \end{vmatrix}$ is invertible

69. let A and B be 3*3 matrices such that

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

and $|B| = \frac{1}{10}$ then what

is the value of $|AB^T|$?

$$A = \begin{pmatrix} \alpha & 2 & \beta \\ 2 & 1 & 3 \\ 0 & 0 & 0 \end{pmatrix}$$

70. If _____ and determinant of coefficient matrix is -5 then what is the value of x?

71. Consider the matrix below then find the required minors and co-factors.

$$A = \begin{pmatrix} -1 & 4 & 7 \\ 3 & 0 & -2 \\ 0 & 0 & 0 \end{pmatrix}$$

a. M_{23}

b. M_{32}

c. C_{23}

d. C_{32}

72. The system of equation

$$\begin{cases} x+y+z=6 \\ x-2y=-4 \end{cases}$$

has no solution then what will be the value of a and b?

A. a=2 & b=16

B. a=-2 & b=16

73. Given matrix

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

then what will be matrix B such that $BA = B + A$?

74. If

$$A = \begin{pmatrix} 2 & 7 \\ 0 & 0 \end{pmatrix}$$

then $(AB)^{-1} = \underline{\hspace{2cm}}$.

79. Solve $\frac{2-i}{x-yi} = 1 + \sqrt{-4}$ then $x = \underline{\hspace{1cm}}$ & $y = \underline{\hspace{1cm}}$

80. Show that the simplified form of $i^{16} - i^{20} + i^{25}$ is i.

81. Show that $\overline{\left(\frac{3-4i}{1-2i}\right)} = \sqrt{5}$

82. For a complex number z , solve the equation $z^3 + 8 = 0$

83. Show that $|z + 2yi| = 4$ determine the geometric horizontal ellipse centre at the origin. Assume that $z = x + yi$

84. Which of the following is the simplest form of $\frac{4-3i}{3+4i} + \overline{1-2i}$?

85. The solution set of the equation $x^2 - 2x + 5 = 0$

86. Polar form of the complex number $z = \left(\frac{2}{1 + \sqrt{3}i} \right)^2$ is:

A. $z = \cos 120^\circ + i \sin 120^\circ$

C. $z = \cos 60^\circ + i \sin 60^\circ$

B. $z = \cos 240^\circ + i \sin 240^\circ$

D. $z = -\cos 120^\circ + i \sin 120^\circ$

87. If $(2x - yi)(3 + i) = 20i$ then find the value of x and y .

88. The simplified form of $\frac{(1-3i)(5+i)}{1+i}$ is:

89. What is the principal argument of $z = (5 + 5i)^{11}$?

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

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

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

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

90. If $z_1 = \frac{2-i}{1+i}$ and $z_2 = \frac{1+i}{1-i}$ then what is the value of $(z_1 + 2z_2) =$ _____

A. $1 + i$

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

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

D. $1 - i$

