

Dej\Wondirad Senior Secondary School Grade 12 Mathematics Worksheet for Natural Science

(Oct. 2014 E. c)

Choose the best answer and write the letters of your choice on the answer sheet provided

- The equivalent definition of the function given by $f(x) = \begin{cases} 2x, & x \geq 0 \\ 0, & x < 0 \end{cases}$ is
 A. $f(x) = |x|$ B. $f(x) = 2x$ C. $f(x) = |x| + x$ D. $f(x) = 2|x|$
- Suppose $h(x) = (f \circ g^{-1})(x)$ and $f(1) = 2, f(-3) = 5, g(-3) = 1, g(1) = 10$, then $h(1) =$ _____
 A. -6 B. 5 C. 2 D. 1
- Let $f: \mathbb{R} \rightarrow B$ is defined by $f(x) = x^2 + 4x + 7$. What should be set B so that f is an onto function?
 A. $[3, \infty)$ B. $(\infty, 4]$ C. $[7, \infty)$ D. $\mathbb{R}$
- If $f(x) = e^{2x} - 3$, then which of the following is equal to $f^{-1}(x)$?
 A. $\frac{1}{2} \ln(y - 3)$ B. $\frac{1}{2} \ln\left(\frac{y+3}{2}\right)$ C. $\sqrt{\ln(y + 3)}$ D. $\frac{1}{2} \ln(y + 3)$
- What is the n^{th} term of the sequence 25, -125, 625, -3125, ... ?
 A. $(-5)^{2n-1}$ B. $(-1)^{2n} 5^{n+1}$ C. $(-1)^{2n-1} 5^{n+1}$ D. $(-1)^{n-1} 5^{n+1}$
- How many two-digit numbers are divisible by 4?
 A. 21 B. 22 C. 24 D. 25
- A 32- team Ethiopian super league has birr 320,000 to be awarded as prize money, if the last-place team is awarded birr 5,500 in prize money and the award increases by the same amount for each successive finishing place, how much will the first team receive?
 A. Birr 11,000 C. Birr 14,500
 B. Birr 12,500 D. Birr 10,250
- If the second term of a $G.P$ is 2 and the sum of its infinite terms is 8, then the $G.P$ is
 A. $8, 2, \frac{1}{2}, \frac{1}{8}, \dots$ C. $4, 2, 1, \frac{1}{2}, \dots$
 B. $10, 2, \frac{2}{5}, \frac{2}{25}, \dots$ D. $6, 3, \frac{3}{2}, \frac{3}{4}, \dots$
- The sum of the series $\sum_{n=2}^{\infty} \left[\left(\frac{3}{4}\right)^{n+1} \left(\frac{2}{3}\right)^{n-1} \right]$ is equal to
 A. $\frac{27}{32}$ B. $\frac{9}{16}$ C. $\frac{1}{2}$ D. $\frac{27}{16}$
- The $\lim_{x \rightarrow 0} \frac{\tan x - \sin x}{x^3}$ is equal to
 A. 0 B. $\frac{1}{2}$ C. 2 D. $\frac{3}{2}$
- If $\frac{x-4}{x^3+2x} = \frac{A}{x} + \frac{Bx+C}{x^2+2}$, then the sum $A + B + C$ is equal to
 A. -2 B. 2 C. 1 D. 0

12. Which of the following is true about the graph of $f(x) = \frac{x^2+2x+1}{2x^2-10x+12}$?
- Its y- intercept is the point (0,6)
 - Its horizontal asymptote is $y = 2$
 - Its vertical asymptote are $x = 3$ and $x = 2$
 - The graph is symmetrical with respect to the y-axis
13. The simplified form of the rational expression $\frac{2}{x-1} + \frac{3}{x+1} - \frac{4x-2}{x^2-1}, x \neq -1, 1$
- $\frac{x+1}{x-1}$
 - $\frac{1}{x+1}$
 - $\frac{1}{x-1}$
 - 1
14. Which one of the following is equal to the complex conjugate of $\frac{i-\sqrt{3}}{1+i\sqrt{3}}$?
- $-i$
 - $2 + i$
 - $\frac{-1}{2} - \frac{3}{4}\sqrt{3}i$
 - $\frac{2\sqrt{3}-3}{4} - \frac{(2+3\sqrt{3})}{4}i$
15. The modulus and argument of the complex number $\frac{1+2i}{1-3i}$ are respectively
- $\sqrt{2}, \frac{3\pi}{4}$
 - $\frac{1}{\sqrt{2}}, \frac{\pi}{4}$
 - $\frac{1}{\sqrt{2}}, \frac{3\pi}{4}$
 - $2\sqrt{2}, \frac{2\pi}{3}$
16. The line through the points $(m, -9)$ and $(7, m)$ has slope m , then the x-intercept of this line is
- 18
 - 6
 - 6
 - 18
17. Which of the following is NOT true about the parabola $y^2 + 6y - 8x - 31 = 0$?
- Focus is at $(-1, -5)$
 - $x + 5 = 0$ is the directrix
 - $y + 5 = 0$ is the axis of symmetry
 - the vertex is at $(3, -5)$
18. Which of the following is NOT true about the ellipse with foci $(-1, 0)$ and $(1, 0)$ and eccentricity $\frac{1}{3}$?
- It major axis is 6 units
 - It latus rectum is $\frac{8}{3}$
 - its equation is $\frac{x^2}{9} + \frac{y^2}{8} = 1$
 - Its vertices are $(-3, 0)$ and $(3, 0)$
19. Which of the following is NOT true about the hyperbola whose general equation is $25x^2 - 4y^2 - 8y - 150x + 121 = 0$?
- Its center at $(3, -1)$
 - The asymptote is $2y - 5x + 17 = 0$
 - It vertices are $(1, -1)$ and $(5, -1)$
 - Eccentricity equal to $\frac{\sqrt{26}}{2}$
20. Let p and q be propositions with truth value True and False respectively. Then which of the following is correct?
- $\neg p \Rightarrow q$ is False
 - $(p \vee \neg q) \Rightarrow q$ is True
 - $(p \Rightarrow q) \wedge p$ is True
 - $p \vee (q \wedge \neg q)$ is True
21. Which of the following propositions is a tautology?
- $(p \Rightarrow q) \wedge (\neg p \vee q)$
 - $(p \Rightarrow q) \vee (\neg p \vee q)$
 - $(p \Rightarrow q) \Rightarrow (\neg p \wedge q)$
 - $(p \Rightarrow q) \Leftrightarrow (\neg p \vee q)$

22. If mean of the following frequency table is 50. and the total number of frequencies are 120, then the missing frequencies are

Class	0 – 20	20 – 40	40 – 60	60 – 80	80 – 100
Frequency	17	f_1	32	f_2	19

- A. 28, 24 B. 24, 36 C. 38, 28 D. None of these
23. Which of the following is the constant term of $\left(2x + \frac{1}{x}\right)^6$?
- A. 8 B. 130 C. 160 D. 30
24. A family has two children. What is the probability that both the children are boys give that at least one of them is boy?

- A. $\frac{1}{4}$ B. $\frac{3}{4}$ C. $\frac{1}{3}$ D. $\frac{2}{3}$

25. If $\begin{pmatrix} 3 & -2 & a \\ 4 & -1 & 2 \end{pmatrix} \begin{pmatrix} -1 & 3 \\ 2 & b \\ 3 & -2 \end{pmatrix} = \begin{pmatrix} 5 & -11 \\ 0 & 2 \end{pmatrix}$, then the value of a and b respectively are

- A. 4 and 6 B. 6 and -4 C. -4 and 7 D. 4 and -2

26. If $A = \begin{pmatrix} 0 & x & 0 \\ 1 & -1 & 1 \\ 0 & y & -1 \end{pmatrix}$ and $A^{-1} = \begin{pmatrix} 1 & 1 & 1 \\ 3 & 0 & 0 \\ 2 & 0 & -1 \end{pmatrix}$, then what is the value of x and y ?

- A. $x = 3$ & $y = -2$ B. $x = \frac{2}{3}$ & $y = \frac{1}{3}$ C. $x = -3$ & $y = 2$ D. $x = \frac{1}{3}$ & $y = \frac{2}{3}$

27. If $\begin{cases} 2x - 5y + 7z = 6 \\ x - 3y = 3 - 4z \\ 3x + ay + 11z = b \end{cases}$ is given then for what values of A and B does the equation has one solution?

- A. $a = -8$ & $b = 9$ C. $a \neq -8$ and b are any real numbers
B. $a \neq -8$ & $b \neq 9$ D. $a = -8$ & $b = -9$

28. Which of the following is **NOT** true?

- A. $\frac{d}{dx}(\log_5^{3x}) = \frac{3}{3x(\ln 5)}$ C. $\frac{d}{dx}(\cos(\sin x)) = -\sin(\sin x) \cos x$
B. $\frac{d}{dx}(\cos x^5) = -5x^4 \sin x^5$ D. $\frac{d}{dx}(3^{\sin x}) = 3^{\sin x} (\ln 3)$

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

- A. e B. e^{-2} C. e^{-2} D. 1

30. Let $f(x) = \begin{cases} ax - b, & x \leq 1 \\ 3x, & 1 < x < 2 \\ bx^2 - a, & x \geq 2 \end{cases}$, if f is continuous function then (a, b) is equal to

- A. (1, 2) B. (1, 3) C. (3, 6) D. (6, 3)

31. The $\lim_{x \rightarrow 0} \frac{3^x - 1}{\sqrt{1+x} - 1}$ is equal to
 A. 1 B. $\log_e 3$ C. $\log_e 9$ D. $3\ln 2$
32. The equation of the line that is tangent to the graph of $y = \sqrt{x} - \frac{1}{\sqrt{x}}$ at $x = 1$ is
 A. $y = x - 1$ B. $2y = x - 1$ C. $y = x$ D. none
33. If $f'(x) = xf(x)$ and $f(3) = -5$, then $f''(3) =$ ____
 A. 27 B. 15 C. 4 D. -50
34. If $x = 2n^2 + 8$ and $y = \sqrt{n^3}$, then $\frac{dy}{dx}$ at $n = 1$ is
 A. 6 B. 2 C. $\frac{3}{4}$ D. $\frac{3}{8}$
35. What is the value of $a + b$ if $f(x) = \begin{cases} 2ax^2 - x, & \text{for } x > 3 \\ x^3 + bx, & \text{for } x \leq 3 \end{cases}$ is differentiable at $x = 3$?
 A. 3 B. 8 C. 24 D. 11
36. If $f(x) = x(m - \ln x)$ such that m is a constant, the curve of the function has a critical point at $x = e$, then $m =$ ____
 A. 1 B. 0 C. e D. 2
37. Let f, g and h be differentiable functions such that $f(x) = g(x) + c$, for some $c \in \mathbb{R}$. If $f'(x) = e^{-x} - 2$ and $\frac{d}{dx}(f(x) + g(x) - h(x)) = e^{-x}$, then $h'(x) =$ ____.
 A. $2 - g'(x)$ B. $e^{-x} - 2 + g'(x)$ C. $e^{-x} - 4$ D. $2e^{-x} + 2$
38. Let f be a function given by $f(x) = x^3 - 12x + 3$ on $[-3, 3]$, then which of the following is **not** true?
 A. The maximum value of $f(x)$ on $[-3, 3]$ is 19
 B. The minimum value of $f(x)$ on $[-3, 3]$ is -13.
 C. The inflection point of the graph of $f(x)$ is at $(0, 3)$.
 D. The graph of $f(x)$ is concave up ward on the interval $(-\infty, 0)$.
39. A cone whose height is always equal to its diameter is increasing in volume at the rate of $40 \text{ cm}^3/\text{sec}$. At what rate is the radius increasing when its circular base area is 1 m^2
 A. 1 cm/sec B. 2 cm/sec C. 0.001 cm/sec D. 0.002 cm/sec
40. $\int \left(x^\pi + \pi^x + \frac{\pi}{x} + \frac{x}{\pi} + \pi x + \pi^\pi \right) dx$ is equal to
 A. $\frac{x^{\pi+1}}{\pi+1} + \pi^x + \ln|x| + \pi^\pi + c$ C. $\frac{x^{\pi+1}}{\pi+1} + \pi^x + \ln \pi + \pi^\pi x + c$
 B. $\frac{x^{\pi+1}}{\pi+1} + \frac{1}{\ln \pi} \pi^x + \ln|x| + \frac{\pi}{2} x^2 + \pi^\pi + c$ D. $\frac{x^{\pi+1}}{\pi+1} + \frac{\pi^x}{\ln \pi} + \pi \ln|x| + \frac{1}{2\pi} x^2 + \pi^\pi x + c$
41. $\int \frac{\cot x}{\sqrt{\sin x}} dx$ is equal to
 A. $-\frac{2}{\sqrt{\sin x}} + c$ B. $\frac{2}{\sqrt{\sin x}} + c$ C. $2\sqrt{\sin x} + c$ D. $\frac{1}{2\sqrt{\sin x}} + c$

42. $\int_{-1}^1 \frac{7x+3}{(7x^2+6x+8)^2} dx$ is equal to
 A. $\frac{4}{63}$ B. $\frac{2}{63}$ C. 1 D. $\frac{5}{36}$
43. The area of the region bounded by the curves $f(x) = 12 - x^2$ and $g(x) = 2x^2$ is
 A. 36 B. 16 C. 32 D. 72
44. The trigonometric expression $\cos^2(\theta) - \sin^2(\theta)$ is equal to
 A. $2\sin^2\theta - 1$ B. $1 + 2\sin^2\theta$ C. $2\sin^2\theta + 1$ D. $1 - 2\sin^2\theta$
45. Which one of the following is a unit vector perpendicular to both $A = (1,0,1)$ and $B = (1,1,1)$?
 A. $(\frac{-1}{2}, 0, \frac{1}{2})$ B. $(-\frac{1}{\sqrt{2}}, 0, \frac{1}{\sqrt{2}})$ C. $(-1,0,1)$ D. $(\frac{1}{\sqrt{2}}, \frac{-1}{\sqrt{2}}, 0)$
46. The image of the point $(1,3)$ when reflected along the line $x - 2y - 5 = 0$ is
 A. $(\frac{4}{3}, \frac{-11}{3})$ B. $(-6, \frac{-1}{2})$ C. $(3, -1)$ D. $(5, -5)$
47. $\tan^{-1}\left(\sin\left(-\frac{\pi}{2}\right)\right)$ is equal to
 A. $\frac{5\pi}{4}$ B. $\frac{7\pi}{4}$ C. $\frac{\pi}{4}$ D. $-\frac{\pi}{4}$
48. The x- axis cuts the sphere $(x - 5)^2 + (y + 2)^2 + (z - 6)^2 = 49$ at two points A and B, then the length of AB is
 A. 8 units B. 10 units C. 7 units D. 6 units
49. If $\vec{a} = i + 2j - 3k$ and $\vec{b} = 3i - j + 2k$ are vectors in space, what is the cosine of angle between $2\vec{a} + \vec{b}$ and $\vec{a} + 2\vec{b}$?
 A. $\frac{31}{50}$ B. $5\sqrt{2}$ C. $\frac{34}{50}$ D. None
50. Which of the following is **NOT** true about the function $f(x) = -2\cos\left(\pi x + \frac{\pi}{3}\right)$?
 A. The period of $f(x)$ is 2 B. $f(x) > 0$ for $\frac{1}{6} < x < \frac{7}{6}$ C. if $x \in [\frac{-1}{3}, \frac{1}{6}]$, then $f(x) \in [0, 2]$ D. the graph of $f(x)$ is increasing on $[\frac{2}{3}, \frac{5}{3}]$

