GENERAL DIRECTIONS:

THE BOOKLET CONTAINS **MATHEMATICS** EXAMINATION FOR **GRADE 12TH**. THE EXAMINATION CONTAINS **60** MULTIPLE CHOICES QUESTIONS**.**

THERE IS ONLY ONE BEST ANSWER FOR EACH QUESTION. CHOOSE THE BEST ANSWER FROM THE SUGGESTED OPTIONS AND CAREFULLY BLACKEN THE LETTER OF YOUR BEST CHOICE ON THE SEPARATE ANSWER SHEET PROVIDED.

YOU ARE ALLOWED TO WORK ON THE EXAM FOR **3 HOURS.** WHEN TIME IS CALLED, YOU MUST IMMEDIATELY STOP WORKING, PUT YOUR PENCIL DOWN, AND WAIT FOR FURTHER INSTRUCTIONS.

ANY FORM OF CHEATING OR AN ATTEMPT TO CHEAT IN THE EXAN WILL RESULT IN AUTOMATIC DISMISSAL FROM THE EXAM CLASS AND CANCELLATION OF YOUR SCORE.

PLAESE MAKE SURE THAT YOU HAVE WRITTEN ALL THE REQUIRED INFORMATION ON THE ANSWER SHEET BEFORE YOU START TO WORK ON THE EXAM.

DO NOT TURN THIS PAGE UNTILL YOU ARE TOLD TO DO SO

1. Which one of the following relations is a function?

   A, $R=\{(x,y):x,y\in R\wedge y>x-2\}$

   B, $R=\{(x,y):x,y\in R\wedge x^2+y^2=2\}$

   C, $R=\{(x,y):x,y\in R\wedge y=x+3\}$

   D, $R=\{(-1,6),(0,6),(2,5),(-1,\sqrt{2}),(1,5)\}$

2. Which one of the following pairs of functions are **not** inverses of each other?

   A, $f(x)=e^x$ and $g(x)=lnx$ B, $f(x)=\frac{x+3}{2x-1}$ and $g(x)=\frac{2x+1}{x-3}$

   C, $f(x)=(x-1)^2$ and $g(x)=\sqrt{x}+1$ D, $f(x)=\sqrt[3]{x+1}$ and $g(x)=x^3-1$

3. If $x=\frac{\sqrt{5}-\sqrt{3}}{\sqrt{5}+\sqrt{3}}$ and $y=\frac{\sqrt{5}+\sqrt{3}}{\sqrt{5}-\sqrt{3}}$ then, the value of x^2+y^2 is:

   A, 15 B, 64 C, 62 D, $\frac{257}{16}$

4. Which one of the following is **not** empty set?

   A, $\{x:x\in R and x^2\leq 0\}$ B, $\{x:x\in R\wedge x^2+1=0\}$

   C, $\{x:x\in R\wedge x^2-x+2=0\}$ D, $\{x:x\in R\wedge x^2<0\}$

5. If the graph of the quadratic function $f(x)=ax^2+bx+c, a\neq 0$ completely lies above the $x axis$, then which one of the following is necessarily **true**?

   A, $a>0$ and $b^2-4ac<0$ B, $a>0$ and $b^2-4ac>0$

   C, $a<0$ and $b^2-4ac>0$ D, $a<0$ and $b^2-4ac<0$

6. Which of the following interval is the solution of the inequality $x^2-5x+4\leq 0$?

   A, $[1,4]$ B, $(-\infty,1]\cup[4,\infty)$

   C, $(-\infty,-4]\cup[-1,\infty)$ D, $[-4,-1]$

7. If the product of the roots of the quadratic equation $(k+1)x^2+(3k+1)x-4k=0$ is three times of their sum, then what is the possible value of k ?

A, $\frac{5}{3}$ B, $\frac{-5}{3}$ C, $\frac{2}{3}$ D, $\frac{-3}{5}$

8. Which one of the following represents an arithmetic sequence?

A, $a_n=n^2-1$ B, $2,4,8,16,\ldots$

C, $-1,\frac{-3}{4},\frac{-1}{2},\frac{-1}{4},\ldots.$ D, $a_n=(-1)^n$

9. Let p,q,r,s,t are the first five consecutive terms of the arithmetic sequence. If $p+q=2$ and $r+s+t=33$, then which one of the following is **not** correct?

A, $p+s=12$ B, $p+r=6$

C, $q+s=14$ D, $r+t=22$

10. The n^{th} term of geometric sequence is $a_n=3.2^{n-1}$. What is the sum of the first 7 terms?

A, 189 B, 381 C, 192 D, 384

11. If $f(x)=\lfloor x \rfloor$, $g(x)=|x|$ and $h(x)=sgn\,x$, then which one of the following is **not** necessarily true?

A, $g(x)=xh(x), for all\, x\in R$ B, $g(x)-f(x)\geq 0, for\, all\, x\in R$

C, $h(x)=\frac{g(x)}{x} for\, all\, x\in R¿0\}$ D, $h(x)\leq f(x) for\, all\, x\in R^{+¿¿}$

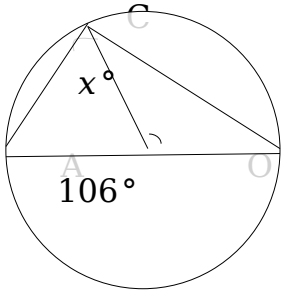
12. Which one of the following is the solution set of an equation $\lfloor \lfloor x \rfloor -1 \rfloor =7$?

A, ¿ B, ¿C,¿ D, ¿

13. A father is four times as old as his son. Eight years ago, the father's age was eight times that of his son. Which one of the following is the sum of their age?

A, 64 B, 70 C, 56 D, 80

14. If O is the center of the circle and $m¿$. What is the value of x?



B

A, 53 B, 74

C, 180 D, 106

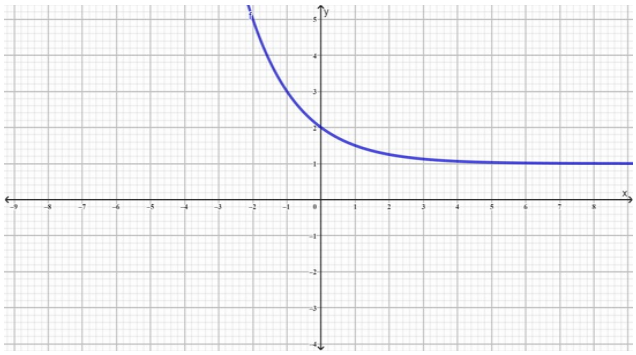
15. If $x+2$ is a factor of $f(x)=x^3-2bx^2+16$, then which one of the following is the value of b?

A, -2 B, 1 C, 2 D, -1

16. If $f(x)=\frac{3}{x-2}$ and $g(x)=4x-3$, then $\left(\frac{g}{f}-2g\right)(3)=$¿

A, 15 B, -15 C, 21 D, 18

17. Let f be a function whose graph is the given below



Which one of the following is equal to $f(x)$?

A, 2^{x+1} B, $1+(\frac{1}{2})^{x}$ C, $1-(\frac{1}{2})^{x}$ D, $2^{x}+1$

18. Which of the following is **true** about a regular hexagon?

A, Has five lines of symmetry

B, The measure of each interior angle is $120°$

C, The sum of the measure of all of its interior angle is $1080°$

D, Has four diagonals from a vertex

19. Given that $\log 600=2.7782$, what is the value of $\log\frac{1}{6}$?

A, -0.7782 B, 0.2218 C, 0.7782 D, -1.2218

20. The sum of all of natural numbers multiple of three less than 100 is

A, 198 B, 1683 C, 1680 D, 408

21. Bontu begins a saving program in which she will save Birr 500 the first year. Each subsequent year she will save Birr 100 more than she did the previous year. How much Birr she will save during tenth year?

A, 950 B, 1400 C, 9500 D, 900

22. The common difference and the sum of the first twenty three terms of the arithmetic sequence are -3 and -805 respectively. Which one of the following is **not** true about this sequence?

A, The first term is -2 B, The general term (n^{th} term) is $1-3n$

C, The 10^{th} term is -29 D, The sum of the first ten terms is -165

23. Which one of the following is true about II quadrant angle θ whose terminal side lies on the line with equation $2x+y=0$?

A, $\sin\theta=\frac{2}{5}$ B, $\cos\theta=\frac{-\sqrt{5}}{5}$

C, $\tan\theta=¿\frac{-1}{2}¿$ D, $sec\theta=\sqrt{5}$

24. Which one of the following expressions is **not** rational expression?

A, $x^{-2}+x^{-1}+3$ B, $\frac{\sqrt{x^4+2x^2+1}}{x-1}$

C, $\frac{2x^3+x^2-5}{x^{\frac{5}{2}}-2x+1}$ D, $5x^3-3x^2+7$

25. Which one of the following is the solution set of $\frac{1}{1-\frac{1}{x}}+\frac{1}{1+\frac{1}{x}}=\frac{\frac{1}{x}+x}{\frac{-1}{x}+x}$?

A, $\{\}$ B, $\{-1\}$ C, $\{-1,1\}$ D, $\{1\}$

26. Which one of the following is the sigma notation expression of $\sqrt{2}+2+\sqrt{6}+2\sqrt{2}+\sqrt{10}+4\sqrt{3}+\sqrt{14}+4+3\sqrt{2}+2\sqrt{5}$?

A, $\sum_{k=2}^{20}2k^{\frac{1}{2}}$ B, $2\sum_{k=1}^{10}\sqrt{k}$

C, $\sqrt{2}\sum_{k=1}^{10}k$ D, $\sum_{k=1}^{10}\sqrt{2k}$

27. Given the sequence $1,-4,9,-16,\ldots$ what is the n^{th} term?

A, $a_n=(-2)^n$ B, $a_n=(-1)^n n^2$

C,$a_n=(-1)^{n-1}n^2$ D, $a_n=(-1)^{2n}$

28. If $5^r5^{r2}5^{r3}5^{r4}\ldots.=5$, then what is the value of r ?

A, 1 B, 5 C, 10 D, $\frac{1}{2}$

29. The equation of the line that passes through the point $(3,1)$ and perpendicular to the line with equation $l;2x-y+1=0$ is

A, $x+2y+5=0$ B, $2x-y-5=0$

C, $x+2y-5=0$ D, $2y-x+1=0$

30. The lower and upper bases of a frustum of a right circular cone have radii 6cm and 4cm respectively, if the height of the frustum is 3cm ,then its volume is:

A, $76\pi cm^3$ B, $70\pi cm^3$ C, $64\pi cm^3$ D, $98\pi cm^3$

31. The solution set for the rational inequality $2-\frac{x}{x+1}\leq\frac{3}{x+1}$ is

A, $\{x:-2\leq x\leq 2\}$ B, $\{x:-1\leq x\leq 1\}$

C, $\{x:x\leq -1\}\cup\{x:x\geq 1\}$ D, $\{x:0\leq x\leq 1\}$

32. Which one of the following is maximum interval on which the function $f(x)=\frac{\sqrt{4-x^2}}{x-1}$ is differentiable?

A, $(-2,1)\cup(1,2)$ B, $(-\infty,2)\cup(2,\infty)$ C, $(1,2)$ D, $(-2,2)$

33. If $f'(x)\geq 0$ for all x in R, then which one of the following **must be** true?

A, $f(x)$ is increasing for all x B, $f(x)$ is decreasing for all x

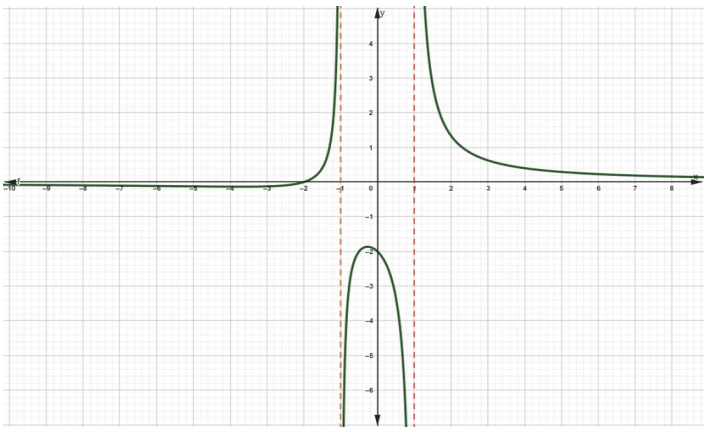
C, $f(x)$ has a maximum at $x=0$ D, $f(x)=0$ for all x

34. Let $f(x)=x^2+mx+n$, what are the values of m and n respectively such that $f(1)=3$ is an absolute minimum value of f on the interval $[0,3]$?

A, $-4\wedge 2$ B, $4\wedge -2$

C, $-2\wedge 4$ D, $2\wedge -4$

35. Which of the following function best describes the graph given below?



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

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

36. If $f(x)=x^3-\frac{1}{x^3}$, then $\frac{f(x)}{f(\frac{1}{x})}$ is equal to:

A, $\frac{1}{x^3}$ B, 1

C, -1 D, 0

37. If $F(x)$ is an anti derivative of $f(x)=-3x^2+1$ and $F(2)=-4$, then $F(-1)$ is equalto:

A, -2 B, 2

C, -1 D, 1

38. What is the instantaneous rate of change of $h(x)=x^4+2x^3-x+5$ at $x=-1$?

A, 5 B, 1

C, -1 D, 2

39. If $f(x)=x+2$ and $g(x)=x^2+1$, what is the derivative of $\frac{f}{g}(x)$?

A, $\frac{1}{2x}$ B, $\frac{1}{(x^2+1)^2}$

C, $\frac{4x-x^2+1}{(x^2+1)^2}$ D, $\frac{x+2}{(x^2+1)^2}$

40. If $A=\begin{pmatrix}1 & 0\\ 2 & 3\end{pmatrix}$ and $2A+B^{-1}=A^TA$, then which of the following matrix is equal to B?

A, $\begin{pmatrix}3 & 6\\ 2 & 3\end{pmatrix}$ B, $\begin{pmatrix}-1 & 2\\ \frac{2}{3} & -1\end{pmatrix}$

C, $\begin{pmatrix}-1 & \frac{2}{3}\\ 2 & -1\end{pmatrix}$ D, $\begin{pmatrix}3 & 2\\ 6 & 3\end{pmatrix}$

41. If $A=\begin{bmatrix}0 & x-5 & y-2\\ 3 & 0 & -1\\ 6 & -1 & 0\end{bmatrix}$ is skew symmetric matrix, then what are the values of $x$and$y$ respectively?

A, 8and8 B, 2and-4

C, $-2\wedge 4$ D, -4and2

42. The solution set of the system $\begin{cases} x+2y-4z=1 \\ x-y+z=-2 \\ 2x+y-5z=-1 \end{cases}$ is:

A, $\{(-1,-1,0)\}$ B, $\{(-1,1,0)\}$

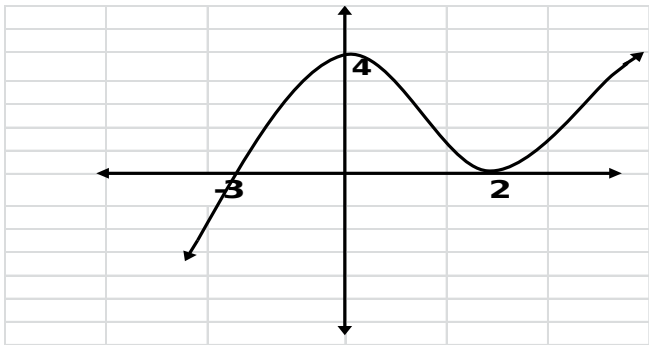
C, $\{(-1,0,1)\}$ D, $\{(1,1,0)\}$

43. Which one of the following point is at where the function $f(x)=\frac{1}{\sqrt{2x-1}}$ has a horizontal normal line?

A, $x=0$ B, $x=-1$

C, $x=\frac{1}{2}$ D, $x=1$

44. Suppose $f(x)$ is differentiable at all $x\in(-\infty,\infty)$ and the graph of $y=f'(x)$ is shown in the figure below, which of the following is **true** ?



A, f ¿) has local extreme at $x=2$ B, $f(x)$ increase on $(-\infty,0]\cup[2,\infty)$

C, $f(x)$ has local minimum value at $x=3$ D, $f(x)$ has local maximum at $x=0$

45. There are three students in the room with age 10, 12 and 14. If another 12 year aged student enters the room, which one of the following is **correct**?

A, Mean age and standard deviation will stay the same

B, Mean age stays the same but standard deviation will increase

C, Mean age and standard deviation will increase

D, Mean age will stay the same and standard deviation will increase.

46. A student needs to select 3 books from 4 different mathematics, 3 different physics and one chemistry book on the shelf. Then what will be the probability that one of the selected books is mathematics and the other two are either physics or chemistry?

A, $\frac{15}{56}$ C, $\frac{3}{8}$ B, $\frac{3}{7}$ D, $\frac{6}{14}$

47. The derivative of $\frac{3}{5}(x^2-7)^{10}$ is equal to:

A, $12x(x^2-7)^9$ B, $6x(x^2-7)^9$

C, $\frac{3}{10}(2x)^{10}$ D, $6(x^2-7)^9$

48. The radius of a spherical balloon is increasing at rate of $0.5\ cm/s$. At what rate the surface area of the balloon is increasing when the radius is 2cm?

A, $16\pi cm^2/s$ B, $8\pi cm^2/s$ C,$4\pi cm^2/s$ D, $2\pi cm^2/s$

49. Which of the following is a vector equation of line tangent to the circle $(x-3)^2+y^2=4$ at the point $(3,2)$?

A, $x+y=5$ B, $y=4$

C, $x=3$ D, $y=2$

50. In the $xy-$¿ plane, if $(5i+5j)-\vec{v}=(3i+2j)-2(i-3j)$ then the magnitude of vector $\vec{v}$ is:

A, $\sqrt{7}$ B, 11 C, 5 D, $\sqrt{24}$

51. Let $u=(2,1)\wedge v=(0,1)$be two vectors in the plane and $w=2u+v$ then which one is the unit vector in the direction of w ?

A, $\frac{4i}{5}+\frac{3j}{5}$ B, $4i+3j$ C, $\frac{-4i}{5}+\frac{3j}{5}$ D, $\frac{4i}{5}-\frac{3j}{5}$

52. If a translation takes the origin to the point $(1,-1)$, then what is the image of a circle with equation $x^2+y^2+4x-6y+9=0$ under this translation?

A, $x^2+y^2-2x+4y+1=0$ B, $x^2+y^2+2x-4y+1=0$

C, $x^2+y^2+2x-4y+5=0$ D, $x^2+y^2-2x+4y+5=0$

53. Which one of the following not Correct about the function $f(x)=x^3-\frac{15}{2}x^2+12x-1$?

A, f is decreasing on $[1,4]$

B, f has local maximum value of 10 at $x=1$

C, f is increasing on $(-\infty,1]\cup$¿

D, f has local minimum value of -9 at $x=4$

54. Let $f(x)=\sqrt{x}$ which one of the following is **not** true ?

A, f has vertical tangent line at $x=0$. C, f has no critical points.

B, f has horizontal normal line at $y=0$. D, f is increasing function.

55. If $f(x)=\frac{1}{x}$, then what is the value of $\int_1^e f(x)dx$?

A, 1 B, e C, $\frac{1}{e}$ D, 0

56. What is the area (in square units) of the region enclosed by the function $f(x)=x^3-4x$ and x-axis? A, -8 B, 8 C, 0 D, 4

57. Given the data set : $15,12,13,12,13,13,12,14,12,\wedge 14$ which one of the following statement is **true** about the data?

A, Median ¿12.5 B, Upper quartile ¿14 C, Lower quartile ¿13 D, Mean ¿12

58. The mark of 50 students are given below

X	$0-10$	$10-20$	$20-30$	$30-40$	$40-50$
f	5	8	f_1	10	f_2

If the median of the data is 26 and $f_2>2$, then what are the values of f_1 and f_2 respectively?

A, $7\wedge 20$ B, $12\wedge 15$ C, $20\wedge 7$ D, $15\wedge 12$

59. The following table shows mark distribution of students in mathematics out of 50

Score	30-32	33-35	36-38	39-41	42-44	45-47
No students	12	18	16	12	8	6

Which one of the following is **not** true about the data ?

A, 25% of students scored 33.5 and below. C, The inter quartile range of the distribution is 9

B, The average score to two decimal is 37.16 D, The median of the distribution is 36.7.

60. Which one of the following statement is **not** true about variance?

A, A large value of variance shows that the data values are closer to mean

B, Variance shows variability of a set of numerical data item

C, When the variance of data is close to zero, the data shows less variability.

D, If two set of data have equal mean, then data item with less variance shows less

variability.