BEDELLE IFA BORU SPECIAL BOARDING SECONDARY SCHOOL

Grade 12 Mathematics Units 1-4

Worksheet

Based on new curriculum

By

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UNIT ONE
SEQUENCE AND SERIES

1. Let $a_n = n + cos n\pi$, $n = 1,2,3$ ... be the n^{th} term of a sequence. Then which of the following is true ?(UEE 2004)
   A. The fifth term is 6
   B. The 10^{th} term is 9
   C. $a_7 + a_8 = 15$
   D. $a_7 - a_6 = 1$
2. Which of the following is fourth term of the sequence $\left(cos\left(\frac{n\pi}{2}\right)\right)$?(UEE 2013)
   A. 0.5 B. 1 C. -1 D. 0
3. What is the 50^{th} term of the sequence $3,10,17,24,31,...$? (UEE 2005)
   A. 310 B. 346 C. 510 D. 531
4. What is the seventh term of an arithmetic sequence whose third term is -4 and common difference is 5?(UEE 2015)
   A. 15 B. -15 C. 16 D. -16
5. Let $\{a_n\}_{n=1}^{\infty}$ be a sequence such that $a_{n+1} = -na_n, a_1 = 1, n = 1,2,3,...$ which of the following is not true about the sequence? (UEE 2003)
   A. $a_3 = 2$ B. $a_4 = -3$ C. $a_n > 0$, if n is odd D. $a_n < 0$ if n is even
6. If$\{A_n\}_{n=1}^{\infty}$ is an arithmetic sequence such that its 1^{st} term $A_1 = -5$ and its 5^{th} term$A_5 = 15$, then its 11^{th} term A_{11} is equal to: (UEE 2008)
   A. 40 B. 50 C. 45 D. 55
7. Which of the following relations holds for the sequence: -10, -3, 4, 11, …?(UEE 2009)
   A. $a_{n-1} - 8$ B. $a_{n-1} + 7$ C. $a_{n-1} - 7$ D. $a_{n-1} + 8$
8. The n^{th} term of the sequence: $1, -4, 9, -16, ...$ is : (UEE 2008)
   A. $a_n = (-2)^n$
   B. $a_n = (-1)^{2n}n^2$
   C. $a_n = (-1)^n n^2$
   D. $a_n = (-1)^{n-1}n^2$
9. The general term of the sequence is $a_n = \left(\frac{1}{2}\right)^{1-n}$. Then which of the following is true about this sequence?(UEE 2012)
   A. Its terms are odd numbers
   B. Its terms are natural numbers
   C. 0 is one of its terms
   D. Its terms are non-positive
10. If the k^{th} term of a sequence is $a_k = \frac{(-1)^k(2-k)}{2k-1}$ what is its next term when k is even? (UEE 2002)
    A. $\frac{k-1}{2k+1}$ B. $\frac{k-1}{2k+3}$ C. $\frac{k-3}{2k+1}$ D. $\frac{k+3}{2k+1}$
11. Which one of the following is an arithmetic sequence? (UEE 2007)
    A. 3, 5, 7, 9, 11, ...
    B. 3, 6, 12, 24, 48, ...
    C. -3, 6, -9, 12, -15, ...
    D. 1, 3, 6, 10, 15, 21, ...
12. If the 1^{th} and 4^{th} terms of a geometric progression are 3 and 81 respectively, then what is the common ratio for this progression?(UEE 2012)
    A. 3 B. $\frac{1}{9}$ C. 9 D. $\frac{1}{3}$

13. If the 4^{th} and 7^{th} terms of a geometric sequence are $-\frac{1}{4}$ and -2 respectively, then which of the following is not true? (UEE 2001)
    A. The first term is $-\frac{1}{32}$
    B. The common ratio is 2
    C. The 4^{th} term is 4 times the 2^{nd} term.
    D. The 5th term is -1.
14. Which one of the following represents is a geometric sequence? (UEE 2006)
    A. $3, 1, \frac{1}{3}, \frac{1}{9}, \frac{1}{27}$ ...
    B. $\frac{1}{2}, -\frac{1}{3}, \frac{1}{4}, -\frac{1}{5}, \frac{1}{6}$ ...
    C.1,3,6,10,15, ...
    D. 1, 1.5, 2.5, 3.5, …
15. Which one of the following is a geometric sequence? (UEE 2013)
    A. $0.1, 0.11, 0.12, 0.13, ...$
    B. $8, -4, 2, -1, ...$
    C.0.1, 0.011, 0.0011, 0.000111, …
    D. -3,6,-9,12,-15, …
16. Suppose a geometric sequence $\{G_n\}_{n=1}^{\infty}$has terms $G_{10} = 192$ *and* $G_6 = 12$. Which of the following is equal to G_2 ?(UEE 2002)
    A. $\frac{3}{2}$ B. $\frac{3}{4}$ C. $\frac{3}{8}$ D. $\frac{3}{16}$
17. If a geometric progression $G_2 = -10, G_4 = -\frac{8}{5}$ and G_5 is positive then which of the following is a general formula for G_n?(UEE 2000)
    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. $25\left(-\frac{2}{5}\right)^{n}$
18. If the fifth and tenth terms of a geometric progression are 640 *and* 20 respectively, which of the following numbers are the first terms and the common ratio of the given geometric sequence respectively? (UEE 2016)
    A. 1024 and 2 B. 1024 *and* $\frac{1}{2}$ C. 10240 and 2 D. 10240 *and* $\frac{1}{2}$
19. What is the sum of the first 20 terms of the sequence 3,7,11,15, ... ?(UEE 2000)
    A. 741 B. 820 C. 899 D.903
20. The sum of the integers between 12 and 280 that are divisible by 13 is:
    A. 2920 B. 3000 C. 6150 D. 5166
21. What is the sum of all multiples of 3 between 20 and 200? (UEE 2007)
    A. 7,227 B. 6,570 C. 6,150 D. 5, 166
22. The sum of whole numbers that are less than 100 and leave remainder 2 when divided by 5 is equal to: (UEE 2001)
    A. 990 B. 988 C. 1976 D. 899
23. If the fourth and eighth terms of an arithmetic progression are respectively 0 and -4, then which of the following is true about the progression?
    A. The common difference is 1.
    B. The first term is 3.
    C. The eleventh term is -8.
    D. The sum of the sixth and seventh terms is 5.
24. The sum of the infinite series $\frac{1}{2} - \frac{2}{3^2} + \frac{2^2}{3^3} + \frac{3^3}{3^4} + \cdots$ is equal to:(UEE 2001)
    A. $\frac{1}{7}$ B. $\frac{2}{5}$ C. $\frac{3}{5}$ D. $-\frac{1}{5}$

25. If $\{A_n\}$ is an arithmetic sequence with first term $A_1 = 5$ and fifth term $A_5 = 21$, then the partial sum $\sum_{n=1}^{20} A_n$ is equal to: (UEE 2004)
    A. 760 B.780 C.860 D.870
26. In an arithmetic sequence, the 4^{th} term is 42 and the 10^{th} term is 30. What is the maximum possible partial sum? (UEE 2000)
    A. 1200 B. 900 C. 450 D. 600
27. What is the sum of the series $\sum_{n=0}^{\infty} 2^n 3^{2-n}$?(UEE 2004)
    A. 6 B.18 C.27 D.∞
28. What is the actual value of the sum $\sum_{n=1}^{\infty}\left(\frac{2^n+5^n}{10^n}\right)$?(UEE 2006)
    A. 0.325 B. 1 C. $\frac{5}{4}$ D. $\frac{37}{9}$
29. What is the sum of the series $\sum_{n=1}^{\infty}(-1)^n 3^{-2n}$?(UEE 2006)
    A. $-\frac{1}{8}$ B. -0.13 C. -0.1 D. $\frac{1}{8}$
30. If $\{a_n\}$ is a sequence such that $a_1 = 2$ and $a_{n+1} = a_n + 4$ for all $n \geq 1$then $\sum_{n=1}^{35} a_n$ is equal to: (UEE 2005)
    A. 2460 B. 2458 C. 2450 D. 2442
31. Consider the sequence $\{a_n\}$, $n \geq 1$ where the first term is $a_1 = 2$ and $a_{n+1} = a_n + 4$ for all $n \geq 1$then the sum $a_3 + a_4 + a_4 + \cdots + a_{35}$ is equal to: (UEE 2002)
    A. 2460 B. 2458 C. 2442 D. 2450
32. The sum of the first 8 terms of geometric sequence with first term 0.3 and common ratio $\frac{1}{10}$ is equal to:(UEE 2015)
    A. $\frac{3}{10}\left(\frac{10^8-1}{10^8}\right)$ B. $\frac{1}{3}(\frac{10^8-1}{10^8})$ C. $\frac{1}{3}(\frac{10^8-1}{10^7})$ D. $\frac{3}{10}(\frac{10^8-1}{10^9})$
33. What is the sum of the series $\sum_{n=0}^{\infty}\left(\frac{2^{2n+1}}{5^{n-1}}\right)$? (UEE 2005)
    A. 40 B. 20 C. 10 D. 8
34. The sum of the series $\sum_{n=0}^{\infty}\frac{(-1)^n}{(3^n)^2}$ is equal to:(UEE 2002)
    A. $\frac{9}{8}$ B. $\frac{9}{10}$ C. $\frac{-9}{10}$ D. $\frac{-1}{10}$
35. What is the sum of the series $\sum_{n=0}^{\infty}\left[\left(-\frac{1}{3}\right)^n + 4^{1-n}\right]$? (UEE 2001)
    A. $\frac{1}{12}$ B. $\frac{19}{12}$ C. $\frac{13}{12}$ D. $\frac{25}{12}$
36. Let $S_n = 4n^2, n = 1, 2, 3, ..$the sum of the first n terms of a sequence$\{a_n\}_{n=1}^{\infty}$. Which of the following is the third term a_3?(UEE 2003)
    A. 8 B. 12 C. 16 D. 20
37. Which one of the following statement is not true?
    A. The sum of an infinite geometric sequence is exists only if the common ratio is between -1 and 1
    B. An infinite series is the sum of an infinite sequence of numbers.
    C. Sequence is a function whose domain is a set of positive integers.
    D. The difference between consecutive terms of arithmetic sequence is called common ratio.

53. What is the sum of the series $\sum_{n=1}^{\infty}(3^n 4^{-n})$?(UEE 2010)
A. ∞ B. $\frac{3}{16}$ C. 3 D. 4

54. If $x, 4x+3, 7x+6$ are consecutive terms of geometric sequence what is the values of x?
A. -8 B. -1 C. 1 D. -2

55. What is the value of $\sum_{n=2}^{20}\left(\frac{1}{n-1}-\frac{1}{n}\right)$?(UEE 2010)
A. $\frac{17}{20}$ B. $\frac{23}{20}$ C. $\frac{21}{20}$ D. $\frac{19}{20}$

56. The sequence $\left\{\frac{(n-1)(2n+1)}{1-n^2}\right\}_{n=1}^{\infty}$ converges to:
A. $-\infty$ B. -2 C. 0 D. 1

57. Which one of the following sequence is a convergent sequence?
A. $1, \frac{1}{2}, 1, \frac{1}{3}, 1, \frac{1}{4}, \ldots$? C. $\left\{10^{109}-\frac{1}{100}\right\}_{n=1}^{\infty}$
B. $\{(-1)^n\}_{n=1}^{\infty}$ D. $\left\{\sin(\frac{1}{n})\right\}_{n=1}^{\infty}$

58. A ball is dropped from a building of height 10 meters. Each time the ball bounces, it rises to $\frac{2}{3}$ of its previous height. What is the total distance covered by the ball, when it hits the ground for the 5^{th} time?
A. $\frac{1030}{27}$ B. $\frac{3410}{81}$ C. $\frac{2600}{27}$ D. $\frac{10870}{243}$

59. A business Association gets net profit of birr 3000 at each month. Just after the fifth year, its amount was Birr 230,000. What was the starting amount of the business(in Birr)?(UEE 2004)
A. 47,000 B. 50,000 C. 53,000 D. 56,000

60. Everyday a person saves 5 cents more than the amount he saved on the previous day. His target is to save the total amount of 3225 cent by the end of 30 days. How much must be the starting saving to meet the target? (UEE 2011)
A. 35 cent B. 25cent C. 50 cent D. 60 cent

61. Suppose that every year the amount of atoms of certain radioactive substance is half of its previous year. If there were 6.4×10^8 atoms of the substance during the initial observation, how many atoms of the substance are present by the end of 20 years after the initial observation?(UEE 2003, 2008)
A. 3.2×10^{-20} B. $2^{-14} \times 10^9$ C. $2^{-20} \times 10^8$ D. $2^{-14} \times 10^7$

62. The population of certain city is increasing at the rate of 3% per year. If the population was 100,000 in 2010 E.C then what will be the population in 2020 E.C? (UEE 2010)
(Given $(1.03)^9 = 1.30, (1.03)^{10} = 1.34, (1.3)^9 = 10.60, (1.3)^{10} = 13.78$)
A. 134000 B. 130,000 C. 1,060,000 D. 1,378,000

63. A certain meeting hall has 20 rows of seats. There are 20 seats in the first row, 22 seats in the second row, 24 seats in the third row, and so on. How many seats are there on the last (20^{th}) row of the hall? (UEE 2007)
A. 6 B. 58 C. 760 D. 5240

64. A ball is thrown vertically from ground up to a height of 16m. Each time it drops h meters, it rebounds 0.80h m. noting that the ball travels every height of h twice, what is the total vertical distance travelled by the ball before it comes to rest?

A. 40m B. 80m C. 160m D. 144m

65. Suppose a radioactive material loses one-third of its mass per year. If its current mass is 81g, then how much will its mass be just after 7 years? (UEE 2009)

A. 27g B. $\frac{1}{27}g$ C. $\frac{128}{27}g$ D. $\frac{128}{81}g$

66. The population of certain country is currently 80 million with the growth rate 2% per year

Given	
$(0.02)^9 = 5.12 \times 10^{-16}$,	$(1.02)^9 = 1.19$
$(0.02)^9 = 1.024 \times 10^{-17}$,	$(1.02)^9 = 1.22$

Which one of the following is the approximation of the population after 10 years? (UEE 2005)

A. 81.9 million B. 86.8 million C. 95.2 million D. 97.6 million

67. A factory that produces electric cables had sales Birr 1,000,000 the first day. During each successive days the sales increased by Birr 10,000 every day what is the total sales the factory in the first 10 days(UEE 2013)

A. Birr 10,450,00 B. Birr 20,900,00 C. Birr 1,090,00 D. Birr 10,000,00

UNIT TWO
INTRODUCTION TO CALCULUS

1. If $f(x) = x^5 + 2x$,then $\frac{f(h+1)-f(1)}{h}$, as h closer and closer to zero is equal to: (UEE 2003)

A. 2 B. 7 C. 5 D. ∞

2. If $f(x) = 2x^5 - 3x$,then $\frac{f(x)-f(1)}{x-1}$, as x closer and closer to one is equal to

A. 1 B. -1 C. 7 D. ∞

3. If $f(x) = \frac{x^2}{1+xg(x)}, g(2) = 1\ and\ g'(2) = 10$, then which one of the following is equal to $f'(2)$?(UEE 2006)

A. -8 B. $-\frac{8}{9}$ C. $\frac{3}{4}$ D. $\frac{8}{9}$

4. If $f(x) = x^3$,then $\frac{f(2+h)-f(2)}{h}$, as h closer and closer to zero is equal to: (UEE 2002)

A. 4 B. -4 C. 12 D. ∞

5. Which one of the following statement is NOT true?

A. Derivative is the exact rate at which one quantity changes with respect to another
B. If $f(x)$ has no derivative at a,then a is critical number of f
C. Average rate of change is the same as the gradient of tangent line
D. Gradient of curve at a point is equal to gradient of tangent line at that point

6. Let $f(t) = 4t - t^2$ that an object falls on a certain airless planet, then what is the average speed of the falling object between $t = 3sec$ and $t = 5sec$?

A. 5 B. -4 C. 6 4

7. Let f be differentiable function with $f(1) = -1\ and\ f'(1) = 1$ if $g(x) = (f(2x+1)+2)^2$, then what is the value of $g'(0)$?

A. 4 B. 2 C. -2 D. -4

8. If $f(2)=-3, f'(2)=4, g'(1)=1, g(x)=-5$ *and* $F(x)=f(x+2).g(1-x^2)$, then what is the value of $F'(0)$?

A. 19 B. 0 C. -20 D. -40

9. If the normal line to $f(x)=\sqrt{x}$ at a point of tangency is $y=-2x+18$, what is equation of the line tangent to the curve at the point of contact?

A. $2y=x-1$ B. $y-\frac{1}{4}x-1=0$ C. $2y=x+1$ D. $y-\frac{1}{2}x-1=0$

10. Which one of the following is a point at where the functions $f(x)=\sqrt{x-1}$ has vertical tangent line

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

11. Let $f(x)=x^3-x^2-x+1$, what is equation of normal line at the point where the graph of f crosses the y-axis?

A. $y=x+1$ B. $y=-x+1$ C. $y=2x+1$ D. $y=-x-1$

12. Let $f(x)=x^2+2x+3$ find a number $c\in(1,3)$ such that $f'(c)=\frac{f(3)-f(1)}{2}$? (UEE 2012)

A. -2 B. 2 C. -6 D.6

13. If $f(x)=\frac{ln2}{x^2}$, then $f'(x)$ is equal to: (UEE 2012)

A. $\frac{1+2lnx}{x^3}$ B. $\frac{-2}{x^4}$ C. $\frac{-2ln2}{x^3}$ D. $\frac{1}{2x^2}$

14. Let $f(x)=\frac{1}{(1-\sqrt{x})^2}$. The $f'(4)$ is equal to:(UEE 2012)

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

15. Suppose that a function f has the property that $f(x+y)=f(x).f(y)$ for all values of x and y that $f(0)=2, f'(0)=1$. Then which of the following represents the formula for the derivative $f'(x)$?

A. $f'(x)=2f'(x)+1$ C. $f'(x)=f(x)+2$

B. $f'(x)=f(x)+2f'(x)$ D. $f'(x)=2f(x)-1$

16. If $f(x)=2+|x-3|$ for all x, the value of the derivative $f'(x)$ at $x=3$ is_____(UEE 2008)?

A. -1 B. 1 C. 2 D. does not exist

17. Which one of the following is equation of the tangent line to the graph of $f(x)=\frac{4}{x^2}-2x+4$ at $\big(2,f(2)\big)$?(UEE 2008)?

A. $3x+y=6$ B. $3x+y=7$ C. $6x+y=13$ D. $-6x+y=13$

18. If $h(x)=\sqrt{1+\sqrt{x}}$, then which of the following is equal to $h'(x)$? (UEE 2011)

A. $\frac{1}{2\sqrt{1+\sqrt{x}}}$ B. $\frac{x}{2\sqrt{1+\sqrt{x}}}$ C. $\frac{1}{4\sqrt{x+x\sqrt{x}}}$ D. $\frac{x}{4\sqrt{x+x\sqrt{x}}}$

19. Which one of the following equation of the line tangent to the graph of $f(x)=\frac{3x}{x-1}$ *at* $\big(2,f(2)\big)$?

A. $3y+x=20$ B. $3y-x=16$ C. $y-3x=0$ D. $y+3x=12$

20. If $g(x)=xf(3x+1), f(4)=1 and\ f'(4)=2, then\ g'(1)$ is equal to:

A. 7 B. 6 C. 4 D. 3

21. Let $f(x)=g\big(\sqrt{4x+1}\big). if\ g'(3)=\frac{1}{2}$, then $f'(2)$ is equal to:(UEE 2003)

A. $\frac{2}{3}$ B. $\frac{1}{3}$ C. $\frac{1}{2}\sqrt{5}$ D. $\frac{1}{2}\sqrt{13}$

22. If $f(x)=x^2g(3-x^2), g(2)=3 and\ g'(2)=-4, then\ f'(-1)$ is equal to:

A. 20 B. -14 C. -7 D. -4

23. For $f(x) = x^2\sqrt{2x+12}$, what is equation of the tangent line to the graph of f at $x = 2$?

A. $y - 4 = 16(x-2)$ C. $y = 17(x-2) + 16$

B. $\frac{1}{\sqrt{12}}(x-2)$-16 D. $y = 8(x-2) + 32$

24. Which one of the following is the set of critical numbers of $f(x) = (x^2-9)^{2/3}$?

A. $\{0\}$ B. $\{-3, 0, 3\}$ C. $\{-3, 3\}$ D. $\{-3, 0\}$

25. If $F(x) = f(2x+2).g(1-x^2)$, with $f(2) = -3, f'(2) = 4, g(1) = -5, and\ g'(1) = 1$, then what is the actual value of $F'(0)$?(UEE 2006)

A. -40 B. -20 C. 0 D. 19

26. If $f(x) = \pi^2$, then $f'(1)$ is equal to(UEE 2004)

A. 2π B. π^2 C. 1 D. 0

27. If $f(x) = \pi^2 + 1$, then $f'(x)$ is equal to(UEE 2008)

A. 2π B. $2\pi + 1$ C. 2 D. 0

28. Let $f(x) = \frac{6x}{x+a}$, for what value of a is $f'(a) = 1$? (UEE 2004)

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

29. For $f(x) = x^2\sqrt{2x+12}$, what is the slope of the tangent line to the graph of f at $x = 2$?(UEE 2006)

A. -4 B. 2 C. 18 D. 17

30. If $g(x) = xf(x) - \sqrt{f(x)}$ and $f(2) = f'(2) = 4$, then which of the following is equal to $g'(2)$?(UEE 2005)

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

31. If $g(x) = \frac{f(x)}{x+1} + (f(x))^2, \quad f(1) = 8\ and\ f'(1) = 2, then\ g'(1)$ is equal to: (UEE 2004)

A. 36 B. 31 C. 25 D. 16

32. Let $f(x) = \begin{cases} 3x-1, x \le 2 \\ x+3, x > 2 \end{cases}$ which of the following is true?

A. $f'(2) = 1$ B. $f'(2) = 3$ C. $f'(2) = 5$ D. f has no derivative at 2

33. At what value(s) of x does $f(x) = \frac{1}{3}x^3 - \frac{1}{2}x^2 - 2x + 1$ have a local maximum?(UEE 2004)

A. $x = 2$ B. $x = -1$ C. $x = 5$ D. $x = 2, x = -1$

34. Let $f(x) = x^2 + px + q$ and $f(1) = 3$ is an extreme value of f on the interval $[0, 5]$, then the maximum value of f is _____

A. 20 B. 5 C. 3 D. 9

35. The line $y = -4x + k$ is tangent to the curve $f(x) = 2x^2 + 4x + 1$,then $k =$ _____

A. -7 B. -11 C. -4 D. 7

36. At what value(s) of x does $f(x) = \frac{1}{4}x^4 - 2x^2$ have a local maximum?(UEE 2005)

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

37. If $f'(1) = 4, f(1) = 3$ and $g'(3) = 5$, then $(gof)'(1)$ is equal to

A. 15 B. 20 C.3 D.5

38. Let $f(x) = x^4 - 6x^2 + 1\ on\ [-2, 3]$. Which one of the following is local maximum value of f?

A. $f(0)$ B. $f(\sqrt{3})$ C. $f(3)$ D. $f(-\sqrt{3})$

39. Which of the following is equation of the line tangent to the graph of

$$f(x) = \begin{cases} 3x-1, x \le 2 \\ x+3, x > 2 \end{cases} at\ (\pi, f(\pi))?$$

A. $y = 2x - 2\pi + 1$ C. $y = -2x + 2\pi + 1$

B. $y = x + 3$ D. $y = -2x + 2\pi - 1$

40. The equation of the line tangent to the graph of $f(x) = 3x^2 + 4x - 5$at $x = -1$ is

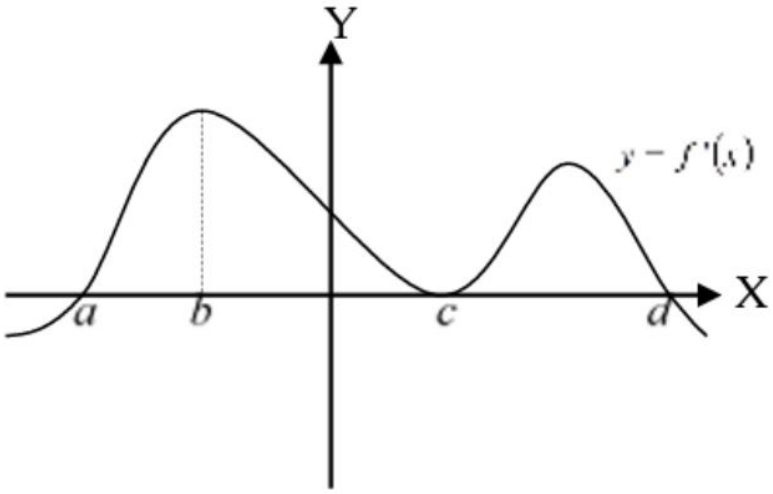
A. $10x - y - 8 = 0$ C. $-10x - y - 8 = 0$

B. $-10x + y - 8 = 0$ D. $10x + y - 8 = 0$

41. Which of the following is the largest interval on which the function $f(x) = \frac{x}{x^2+1}$ is increasing?

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

42. Look at the following graph of $f'(x)$



Which of the following is true about?

A. f is increasing on $[c, d]$ C. f has local minimum at d

B. f is decreasing on $[b, c]$ D. f has local extreme value at c

43. What is the equation of the normal line to the graph of $f(x) = x\sqrt{x^2 + 16}$ at $(0, 0)$?

A. $f(x) = \frac{x}{4}$ C. $y = -\frac{1}{4}x$

B. $y = 4x$ D. $y = 2x + 1$

44. Which one of the following is a point at where the functions $f(x) = 2\sqrt{x}$ has vertical tangent line

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

45. The total cost in (in Birr) of producing x iron sheets per day is $C(x) = 1000 + 100x - 0.5x^2,\ 0 \le x \le 100$. What the marginal (rate of change is of) cost at a production level of 80 iron sheets

A. 8.5 B. 20 C. 1800 D. 5800

46. A man wants to fence two identical rectangular enclosures in a field alongside a straight river as shown as shown in the following figure.



What is the maximum area of each enclosure that he can make with 192 meter fencing material if the side along the river does not need a fence? (UEE 2011)

A. $153m^2$ B. $1564m^2$ C. $1664m^2$ D. $1536m^2$

47. A water tank is a rectangular parallelepiped with base length 3m, width 2m and height 2.5 m. If water is flowing in to the tank at the rate of 0.12 m3 /sec, then how fast does the level of water rise up in the tank?

A. 0.02 m/sec C. 0.04 m/sec

B. B. 0.03m/sec D. 0.06 m/sec

48. Water is poured into cylindrical tanker of radius 5 meters at rate of 10 meter cube/min. what is the rate of change the height of the level of when it rises to 3 meters? (UEE 2004)

A. $\frac{3}{25\pi}m/min.$ B. $\frac{2}{5\pi}m/min$ C. $\frac{1}{\pi}m/min$ D. $\frac{3}{5\pi}m/min$

49. A company manufactures x computer sets per month. The monthly marginal profit in birr is given by $p'(x) = 165 - 0.1x,\ \ 0 \le x \le 400$. The company is currently manufacturing 10 sets of computers per month, but is planning to increase of production. What is the total change in monthly profit if the monthly production is increased to 60 sets

A. Birr 500 B. Birr 1,865 C. Birr 8,075 D. Birr 18,635

50. Water tank is circular cylinder with base radius $2m$ and height $3m$ if the tank is empty and water is pumped into it at rate of $2m^3/min$, how long does it take for the tank to be full?

A. 1.5 min B. $\frac{3}{2}\pi\ min$ C. $6\pi\ min$ D. $12\pi\ min$

51. The volume V of melting ice cube after t seconds is $V = 2000 - 40t + 0.2t^2$ (in cm^3). How fast is the volume changing when $t = 40$ seconds

A. 24 cm^3/sec B. 15 cm^3/sec C. -15 cm^3/sec D. -24 cm^3/sec

52. If air is pumped into a spherical balloon at the rate of $32\pi\ cm^3/sec$, then how fast does the radius of the sphere increase at the moment when the radius is 4cm?(2008)

A. 3/2cm/sec B. 2/3cm/sec C. 2cm/sec D. 1/2cm/sec

53. If the radius r of sphere is increased at the rate of 2cm/min, then the rate change of volume when $r = 1cm$ is

A. $8\pi cm^3/min$ B. $12\pi cm^3/min$ C. $4\pi cm^3/min$ D. $6\pi cm^3/min$

54. What are the length L and width W of a rectangle with perimeter 10,000m that maximizes the area?

A. L= 3000 and W= 2500w C. L= 2500 and W= 2500w

B. L= 5000 and W= 5000w D. L= 2500 and W= 3000w

55. What is the absolute minimum value of $f(x) = x^4 - 2x + 4$ on the interval $[0, 2]$ (UEE 2008)?

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

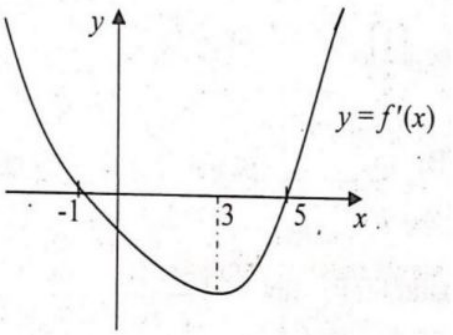
56. Which one of the following is true about the function defined by $f(x) = x^3 - 3x^2$ on $[-1, 3]$?

A. Its critical numbers are 0 and 2 and its maximum value is -4
B. Its critical numbers are 0 and 2 and its maximum value is 0
C. Its critical numbers are 0, 2 and 3 and its maximum value is 0
D. Its critical numbers are 0 and 2 and its maximum value is 15

57. What is the absolute maximum value of $f(x) = 2x^2 - x^4 - 4$ on the interval $[0, 2]$ (UEE 2008)?
A. -3 B. 3 C. -4 D. 12

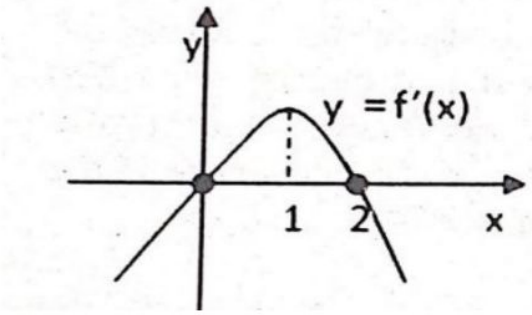
58. Which one of the following is the set of critical numbers of $f(x) = \frac{3}{8}x^{\frac{8}{3}} - 6x^{\frac{2}{3}}$? (UEE 2009)
A. $\{-2, 2\}$ B. $\{-2, 2\}$ C. $\{-2, 2\}$ D. $\{-2, 2\}$

59. Suppose $f(x)$ is differentiable at all $x \in (-\infty, \infty)$ and the graph of $y = f'(x)$ is as shown in the figure below. Which of the following is true (UEE 2002)



A. $f(x)$ increases on $[0, 3]$ C. $f(x)$ attains its minimum value at $x = 3$
B. $f(x)$ decreases on $[-1, 5]$ D. $f(x)$ attains its maximum value at $x = 5$

60. Suppose $f(x)$ is differentiable at all $x \in (-\infty, \infty)$ and the graph of $y = f'(x)$ is as shown in the figure below. Which of the following is true?(2003)



A. $f(x)$ increases on $(-\infty, 1)$ C. $f(x)$ attains its maximum value at $x = 2$
B. $f(x)$ decreases on $(0, 2]$ D. $f(x)$ attains its maximum value at $x = 1$

61. The total cost for ordering and storing x units are given by $C(x) = 3x + \frac{30{,}000}{x}$ birr. How many units must be ordered to produce a minimum cost?
A. 50 B. 100 C. 300 D. 1000

62. Which one of the following is the set of critical numbers of $f(x) = \frac{1}{3}x^3 + |4x - 1|$?(UEE 2006)
A. $\left\{\frac{1}{4}, 2\right\}$ B. $\left\{-2, \frac{1}{4}, 2\right\}$ C. $\{-2, 2\}$ D. $\left\{\frac{1}{4}\right\}$

63. Which one of the following is the set of critical numbers of $f(x) = \frac{4}{3}x^3 + |x|$?(UEE 2010)

A. $\left\{\frac{1}{2}\right\}$ B. $\left\{0, \frac{1}{2}\right\}$ C. $\left\{0, -\frac{1}{2}\right\}$ D. $\left\{-\frac{1}{2}, 0, \frac{1}{2}\right\}$

64. At value of x does the function $f(x) = \frac{4}{3}x^3 - x^4$ attains its maximum value?(UEE 2011)

A. -1 B. 0 C. 1 D. $\frac{4}{3}$

65. On which one of the following intervals does $f(x) = x^4 + 4x$ increase?(UEE 2005)

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

66. Which one of the following is the set of all critical numbers of $f(x) = \begin{cases} 3x - 1, x \leq 2 \\ x + 3, x > 2 \end{cases} at\ (\pi, f(\pi))$?(UEE 2002)

A. $\{1\}$ B. $\left\{\frac{1}{2}\right\}$ C. $\{\ \}$ D. $\left\{\frac{1}{2}, 1\right\}$

67. What is the area of the region between the graph of $y = -x^2 + 1$ and the $x - axis$ where $0 \leq x \leq 2$?(UEE 2008)?

A. $\frac{2}{3}$ B. $\frac{7}{3}$ C. 3 D. 2

68. If $F\ and\ f$ are continuous function on $[a, b]$ such the $F'(x) = f(x)$ for all x, then $\int_a^b f(x)dx$ is

A. $F'(a) - F'(b)$ B. $F'(b) - F'(a)$ C. $F(a) - F(b)$ D. $F(b) - F(a)$

69. Which of the following is anti-derivative of $f(x) = \frac{3}{x\sqrt{x}}$?

A. $\frac{6}{\sqrt{x}} + c$ B. $\frac{-6}{\sqrt{x}} + c$ C. $-\frac{3}{2\sqrt{x}} + c$ D. $-6\sqrt{x} + c$

70. Evaluating $\int_1^3 \sqrt{x}\left(1 - \frac{1}{x}\right)$ gives:

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

71. What is the area of the region between the graph of $f(x) = -x^2 + 4x - 3$ and the x-axis from $x = 0\ to\ x = 3$?(UEE 2006)

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

72. If $f(x)$ is defined by $f(x) = \begin{cases} 3x^2, if\ x \leq 3 \\ 2, if\ x > 3 \end{cases}$, then $\int_0^4 f(x)dx =$ _____

A. 27 B. 8 C. 29 D. 64

73. If $f(x) = x^2 + 2ax + b$ and $f(x) = x^8 - c$ have the same tangent line at (1, 2), then what is the value of $a + b - c$?

A. -1 B. -3 C. -4 C. -5

74. If $F(x)$ is an anti-derivative of $f(x) = 1 - \frac{2}{x^2}$ and $F(1) = 0$, then $F(2)$ is equal to: (UEE 2006)

A. 0 B. $-\frac{1}{2}$ C. $\frac{1}{2}$ D. 3

75. Which of the following is the area of the region enclosed by the graph of $f(x) = x^3$ on the interval$[-4, 2]$? (UEE 2016).

A. 120 square units B.136 square units C. 60 square units D. 68 square units

76. The area of the region bounded between the graph of $f(x) = x^3$ and the x-axis from $x = -1\ to\ x = 2$?(UEE 2002)

A. $\frac{15}{4}$ B. $\frac{17}{4}$ C. 4 D. 16

77. Suppose $\int_1^3 f(x)dx = 6$ and $\int_1^2 f(x)dx = 10$, then what is the value of $\int_2^3 f(x)dx$ (UEE 2013)

A. 4 B. 16 C. -4 D. 2

78. Let f be continuous function on [a, b]. Then which of the following is NOT true

A. $\int_a^b f(x)dx = -\int_b^a f(x)dx$

B. $\int_a^b f(x)dx = \int_a^c f(x)dx - \int_c^b f(x)dx$ for any $c\ in\ (a,b)$

C. $\int_a^b kf(x)dx = k\int_a^b f(x)dx$ for any constant k

D. $\int_c^c f(x)dx = 0$ for any $c\ in\ (a,b)$

79. The acceleration of the body at any time t is given by $a(t) = 4 - 2t + 3t^2$ with initial velocity $v(0) = 5$. Then what is the velocity v of the body as a function of time?

A. $v(t) = 9 - t^2 + t^3$ B. $v(t) = 5 + 4t - t^2 + t^3$

B. $v(t) = -2 + 6t$ D. $v(t) = 1 + 4t - t^2 + t^3$

UNIT THREE
STATISTICS

1. Consider the data set given below 10, 8, 10, 2, 12, 6, 12, 18, 3, 7, 10, 8, 8. Which one of the following coefficient of range of data?

   A. $\frac{5}{4}$ B. 20 C. 16. D. $\frac{4}{5}$

2. Which one of the following is true about the variance and interquartile range?
   A. Both are considering only the middle 50% of the data
   B. Both are affected by extreme values in the data
   C. Both are measures of the variability of each item in the data
   D. Both are absolute measures of dispersion
3. Ten students took two tests, test I, and Test II. The mean mark of test I is 5 with standard deviation 2 and mean mark of Test II is 6 and with standard deviation 2. Which one of the following is true?
   A. The coefficient of variation of test I is 25%
   B. The coefficient of variation of test II is 30%
   C. The students mark in test II is more consistent than test I
   D. The students mark in test I and Test II have the same degree of variability
4. There are three children in room with ages four, five and six. If a five year old child enters the room, then which of the following statement is true?
   A. Mean age and standard deviation will stay the same
   B. Standard deviation will stay the same and the mean will increase
   C. Mean age and standard deviation will increase
   D. Mean age will stay the same but standard deviation will increase
5. Which one of the following is a simple random sampling?(UEE 2016)
   A. First the population is divided into homogeneous groups and a sample is selected from eac homogeneous group

B. First divide the city into ten groups and choose the secondary principals from the randomly selected 3 groups
C. Selecting five students from grade 12 students of the same school randomly
D. Selecting a group randomly from a groups formed by dividing the populations in to groups

6. The mean and standard deviation of 15 observations are found to be 10 and 5, respectively. On rechecking it was found that one of the observations with the value 8 was incorrect. What is the mean and standard deviation respectively if the value of the corrected observation was 23?
A. 11 and 5.9 B. 2.4 and 8 C. 8 and 23 D. 8 and 5.9
7. What is the mean of the first n natural numbers?
A. $\frac{n}{2}$ B. $\frac{n^2+1}{2}$ C. $\frac{n(n+1)}{2}$ D. $\frac{n+1}{2}$
8. Which one of the following is NOT true?
A. If two data have equal mean the data with less variance shows less variability
B. Large value of variance shows that the data values are closer to mean
C. When the values of variance closer to zero, the data shows less variability
D. Variance indicates the variability of a set of numerical data items
9. Which of the following measures is not affected by outliers?
A. Range C. Standard deviation
B. Interquartile range D. Variance
10. A positively skewed distribution means:
A. The mean > median > mode C. The mean = median = mode
B. The mean < median < mode D. The mean = mode > median
11. The sum of the squares of deviation for 10 observations taken from their mean 30 is 90. Find the coefficient of variation.
A. 10% B. 11% C. 12% D. 20%
12. A dataset with a skewness value of zero is:
A. Positively skewed C. Negatively skewed
B. Symmetrical D. Multimodal
13. Which of the following measures is not used to assess skewness?
A. Quartiles C. Mean
B. Mode D. Range
14. The mean of data 1, 3, x, 7, 9 is 5. Then the mean deviation of data from the mean is _____
A. 5.3 B. 2.4 C. 12 D. 5
15. If the mean is to the left of median and mode is to the right of the median, then the distribution is
A. Symmetrical B. positively skewed C. negatively skewed D. can't determined
16. Given data 10, 5, 18, 2, X, 4, 10, 15, 11, 4. If the mean number of given data is 9, what is the mean deviation from the mean of the data?
A. 2.4 B. 3.4 C. 4.2 D. 4.3
17. If the mean deviation of numbers $1, 1+d, 1+2d, \ldots, 1+50d$ from their mean is 260, then which one of the following is the value of d?
A. 20.5 B. 20.3 C. 20.4 D. 10.4

18. Consider the given data set A and B. Data A: 7, 9, 8, 6 and Data B: 4, 7, 9, 8. which one of the following is true about data A and data B?
    A. Coefficient of variation of data A is 27%
    B. Coefficient of variation of data B is 43.4%
    C. Data A is more consistent than data B
    D. Data A is more variable than data B
19. Hasset divided grade 12B students into two groups according to gender and then selected members from each group for her sample. What sampling method was Hasset using?
    A. Cluster C. Stratified
    B. Simple random D. Systematic
20. Which one of the following is true about the range and interquartile range?
    A. Both are considering only the middle 50% of the data
    B. Both are measures of variation of data
    C. Both are affected by extreme values in the data
    D. Both are measures of the variability of each item in the data
21. The marks obtained by 50 students in exam are given below:

Mark	0-10	10-20	20-30	30-40	40-50
No. of students	5	a	20	b	10

    The mean deviation about the median and coefficient of mean deviation about the median are 9 and 0.36 respectively. What is the missing frequency a and b respectively?
    A. 20 and 5 B. 10 and 5 C. 10 and 20 20 and 10
22. Which one of the following is true is normal distribution?
    A. mean < median < mode C. mean = median = mode
    B. mean > median > mode D. mean = median × mode
23. What is the coefficient of range and coefficient of quartile deviation respectively of the following dataset

Class	15-20	20-25	25-30	30-35
f	8	21	15	4

    A. 0.132 and 0.4 B. 6.38 and 0.132 C. 0.4 and 0.132 D. 0.4 and 6.38
24. The mean and coefficient of variation of seven observations are 8 and 50 respectively if 5 of those are 12, 14, 10, 4 and 2, then what are the remaining two observations
    A. 9 and 5 B. 6 and 4 C. 8 and 10 D. 6 and 8
25. A feasible solution to linear programming:
    A. Must be a corner point of feasible region.
    B. Must optimize the value of the objective function.
    C. Need not satisfy all of the constraints, only some of them.
    D. Must satisfy all of the problem's constraints simultaneously.

26. If 25% of the item are less than 20 and 25% are more than 40, then find the quartile deviation.
    A. 10 B. 20 C. 30 D. 40
27. For a group of 100 students the mean and coefficient of variation of their marks were found to be 60 and 25, respectively. Later on it was found that the scores 45 and 70 were wrongly entered as 40 and 27. What are the corrected mean and coefficient of variation respectively?
    A. 55 and 14.5 B. 60.5 and 24.15 C. 60.5 and 14.61 D. 15 and 60.5
28. The mean deviation about the mean and coefficient of mean deviation about the mean of the following distribution are 180 and 10, respectively, then what is the missing frequency f?

X	11-13	13-15	15-17	17-19	19-21	21-23	23-25
F	7	6	9	13	f	5	4

    A. 20 B. 18 C. 4 D. 14

UNIT FOUR
INTRODUCTION TO LINEAR PROGRAMMING

1. The region on a side of a line in the xy-plane is
   A. Linear inequalities B. Objective function C. half-plane D. coordinate
2. The common region determined by all the constraints including the non-negative constraints $x \geq 0, y \geq 0$ of a linear programming problem is called _____
   A. Optimal solution B. feasible solution C. feasible region D. optimal value
3. Which of the following statement is NOT true?
   A. Optimal solution is not unique
   B. Optimal solutions can be occurs at out of the corner points(vertex)
   C. An optimization problem can have infinite many solution
   D. All optimization problems have a solution
4. Any point in the feasible region that gives the optimal value of the objective function is called _____
   A. Optimal solution B. Feasible solution C. infeasible solution D. objective function
5. A point of intersection of two or more boundary lines of a solution region is called_____
   A. Feasible region B. Constraints C. corner point D. optimal point
6. What is the set of all possible solutions that satisfy the constraints called?
   A. Optimal region C. Feasible region
   B. Infeasible region D. Solution set
7. What method is commonly used to solve a linear programming problem graphically?
   A. Substitution method B. Simplex method
   C. Plotting constraints and finding vertices of the feasible region
   D. Elimination method
8. What are the decision variables in a linear programming problem?
   A. Variables that define the constraint C. Variables to be optimized
   C. Random variables D. Auxiliary variables

9. If a feasible region is unbounded, then:
   A. There is no solution C. The solution may or may not exist
   B. The solution always exists D. The objective function has no impact
10. What is the first step in formulating a linear programming problem?
   A. Solve the problem C. Define the decision variables
   B. Draw the graph D. Write the constraints
11. If the feasible region is empty, then the linear programming problem is:
   A. Infeasible C. Unbounded
   B. Optimal D. Redundant
12. The equation $z = ax + by$ in a linear programming problem represents:
   A. A constraint C. The objective function
   C. The feasible region D. The solution set
13. A company produces shirts of black and white colors from polyester and cotton. The company has 6000 units of polyester and 3000 units of cotton in its store. A black shirts requires 5 units of polyester and 4 units of cotton where as a white shirt requires 3 units of polyester and 3 units of cotton. If the company gets a profit of Birr 120 from each black shirt and Birr 200 from each white shirt, what is the maximum profit of the company?(UEE 2016)
   A. 144,000 B. 120,000 C. 344,000 D. 200,000
14. What is the maximum value of $z = 2x + 3y$ subject to the constraints

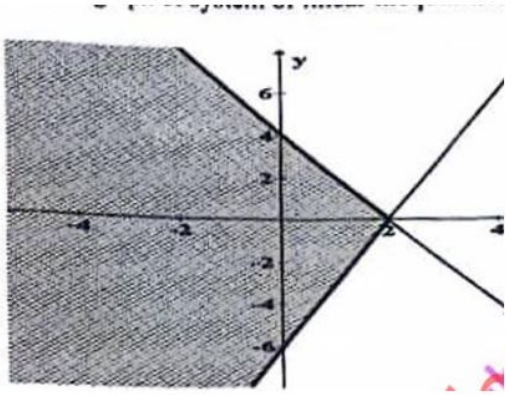
$$\begin{cases} x + y \le 6 \\ 2x - y \le 6 \\ x \ge 0 \\ y \ge 0 \end{cases}$$ (UEE 2016)

   A. 18 B. 22 C. 12 D. 14
15. Which one of the following points in the region of the inequalities : $-x + 3y \le 10, x + y \le 6, x - y \le 2, x \ge 0, y \ge 0$.
   A. (3, 4) B. (1, 1) C. (3, 0) D. (0, 4)
16. Which of the following ordered pair is a solution of the system of linear inequalities

$$\begin{cases} x + y \le 6 \\ 2x - y \le 6 \\ x \ge 0 \\ y \ge 0 \end{cases}$$

   A. (0,0) B. (-1, 1) C. $\left(\frac{-1}{2}, 1\right)$ D. (-1, 0)
17. The region represented by $2x + 3y - 5 \le 0$ and $4x - 3y + 2 \le 0$ is:
   A. Not in first quadrant C. Bounded in first quadrant
   B. Unbounded in first quadrant D. It is in second quadrant

18. Given that the graph of system of linear inequalities shown below



Which one of the following system of linear inequalities is represented by the shaded region in the graph?

A. $\begin{cases} 2x + y \leq 4 \\ 3x - y \leq 6 \end{cases}$ B. $\begin{cases} 2x + y \geq 4 \\ 3x - y \leq 6 \end{cases}$ C. $\begin{cases} 2x + y \geq 4 \\ 3x - y \geq 6 \end{cases}$ D. $\begin{cases} 2x + y \leq 4 \\ 3x - y \geq 6 \end{cases}$

19. Which feasible region of the following system of linear inequalities is unbounded?

A. $\begin{cases} x + 3y \leq 6 \\ 2x + 4y \geq 7 \\ x \geq 0 \\ y \geq 0 \end{cases}$ C. $\begin{cases} 2x - y \geq -4 \\ x + y \geq 2 \\ x \geq 0 \\ y \geq 0 \end{cases}$

B. $\begin{cases} x + y \leq 7 \\ x - y \leq -4 \\ x \geq 0 \\ y \geq 0 \end{cases}$ D. $\begin{cases} 3x + 4y \geq 12 \\ 2x - 3y \leq 6 \\ x \geq 0 \\ 0 \leq y \leq 2 \end{cases}$

20. What is the maximum value of $z = 3x + 5y$

Subject to $\begin{cases} x - 2y \leq 6 \\ x \leq 10 \\ y \geq 1 \\ x \geq 0, y \geq 0 \end{cases}$

A. 5 B. 40 C. 29 D. it has no maximum

21. The maximum value of the objective function $z = 5x + 10y$

Subject to $\begin{cases} x + 2y \leq 120 \\ x + y \geq 60 \\ x - 2y \geq 0 \\ x \geq 0, y \geq 0 \end{cases}$

A. 800 B. 300 C. 600 D. 400

22. Which of the following ordered pair is in the feasible region of the linear programming problem: Objective function $z = -3x + 2y$

23. Subject to $\begin{cases} 2x + y \leq 15 \\ 3x + 8y \leq 30 \\ x \geq 0, y \geq 0 \end{cases}$

A. (4, 7) B. (7, 1) C. (5, 5) D. (3, 3)

24. Which of the following point is not lie in the half-plane $2x + 3y - 12 < 0$?