Ethiopian University Entrance Examination (EUEE)
Mathematics for Social Science Stream
Ginbot 2006/June 2014

BOOKLET CODE: 47 **SUBJECT CODE: 10**
Number of Items: 65 **Time Allowed: 3 hours**

DIRECTIONS: For each of the following problems, choose the best answer from the given alternatives and carefully **blacken** the letter of your choice on the separate answer sheet provided.

1. Which of the following expression is a polynomial expression?

   (A) $x^2 - 3x + \sin x$ (C) $\frac{2+\pi}{1+\pi^2}$

   (B) $\frac{4x^3 + 12x^2 - x}{\pi x^2}$ (D) $2 - 3x^{2/3} + 7x^{5/2} + 3x^{-1}$

2. What is the distance from the origin to the line that passes through $(1,0)$ and $(0,1)$?

   (A) $\frac{1}{2}\sqrt{2}$ (B) 1 (C) $\frac{1}{2}$ (D) $\sqrt{2}$

3. If $z = x + yi$ is a complex number, then $|z|^2 + \frac{1}{2}(z - \bar{z})^2 = 1$ is equivalent to which one of the following equations?

   (A) $x^2 - y^2 = 1$ (C) $x^2 - y^2 = 2$

   (B) $x^2 - 3iy^2 = 1$ (D) $2x^2 - y^2 = 2$

INSTITUTE OF EDUCATIONAL RESEARCH (IER)
ADDIS ABABA UNIVERSITY (AAU)
ETHIOPIAN UNIVERSITY ENTRANCE EXAMINATION (EUEE)
MATHEMATICS FOR SOCIAL SCIENCE, GINBOT 2006/JUNE 2014

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GENERAL DIRECTIONS

THIS BOOKLET CONTAINS ***MATHEMATICS*** EXAMINATION FOR THE **SOCIAL SCIENCE CANDIDATES ONLY**. THE CODE FOR THIS EXAMINATION IS **10** AND THE CODE FOR THIS PARTICULAR BOOKLET IS **47**. PLEASE COPY THESE CODES ON YOUR ANSWER SHEET WHERE IT READS ***BOOKLET CODE AND SUBJECT CODE***.

IN THIS EXAMINATION, THERE ARE A TOTAL OF **65 MULTIPLE CHOICE QUESTIONS.** CAREFULLY SELECT THE BEST ANSWER AND **BLACKEN** ONLY THE LETTER OF YOUR CHOICE ON THE SEPARATE ANSWER SHEET PROVIDED. FOLLOW THE INSTRUCTIONS ON THE ANSWER SHEET AND THE EXAMINATION PAPER CAREFULLY. USE ONLY **PENCIL** TO MARK YOUR ANSWERS. YOUR ANSWER MARK SHOULD BE HEAVY AND DARK, COVERING THE ANSWER SPACE COMPLETELY. PLEASE ERASE ALL UNNECESSARY MARKS COMPLETELY FROM YOUR ANSWER SHEET.

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 EXAMINATION WILL RESULT IN AN AUTOMATIC DISMISSAL FROM THE EXAMINATION HALL AND CANCELLATION OF YOUR SCORE (S).

PLEASE MAKE SURE THAT YOU HAVE WRITTEN ALL THE REQUIRED INFORMATION ON THE ANSWER SHEET BEFORE YOU WORK ON THE EXAMINATION.

DO NOT TURN THIS PAGE OVER UNTIL YOU ARE TOLD TO DO SO.

4. The total cost (in Birr) of producing x iron sheets per day is $C(x)=1{,}000+100x-0.5x^2$, $0 \le x \le 100$. What is the marginal (rate of change of) cost at a production level of 80 iron sheets?
(A) 8.5 (B) 20 (C) 1,800 (D) 5,800

5. A water tank is a circular cylinder with base radius 2m and height 3m. If the tank is empty and water is pumped into it at rate of 2 m^3/min, how long does it take for the tank to be full?
(A) 1.5 min (C) 6π min
(B) $\frac{3}{2}\pi$ min (D) 12 min

6. If the list of a measurement is 10, α, 5, α, 5, 10, 20, 15, 20, 5 with mean $\overline{x}$, then what is the value of α in terms of $\overline{x}$?
(A) $10\overline{x}-90$ (C) $5\overline{x}-90$
(B) $9\overline{x}-90$ (D) $5\overline{x}-45$

7. If $A=\begin{pmatrix}2 & 0 & -1\\ 1 & 2 & 0\\ 0 & 0 & -1\end{pmatrix}$ and $(2A+B)^{\mathrm{T}}=A^{\mathrm{T}}A$, then which one of the following is equal to B?

(A) $\begin{pmatrix}1 & 0 & -2\\ 2 & 0 & 0\\ 0 & 0 & 4\end{pmatrix}$ (C) $\begin{pmatrix}8 & 0 & -4\\ 4 & 8 & 0\\ 0 & 0 & -4\end{pmatrix}$

(B) $\begin{pmatrix}0 & 0 & 0\\ 0 & 0 & 0\\ 0 & 0 & 0\end{pmatrix}$ (D) $\begin{pmatrix}1 & 2 & 0\\ 0 & 0 & 0\\ -2 & 0 & 4\end{pmatrix}$

8. Which one of the following represents a geometric sequence?

(A) $3,1,\frac{1}{3},\frac{1}{9},\frac{1}{27},\ldots$

(B) $\frac{1}{2},-\frac{1}{3},\frac{1}{4},-\frac{1}{5},\frac{1}{6},\ldots$

(C) $1,3,6,10,15,\ldots$

(D) $-3,6,-9,12,-15,\ldots$

9. 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

10. If $F(x)$ is an antiderivative of $f(x)=1-\frac{2}{x^2}$ and $F(1)=0$, then $F(2)$ is equal to:

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

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

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

(B) $\frac{1}{\ell n\left(x^3-1\right)}$

(C) $\ell n\left(1-x^3\right)$

(D) $\left(1+e^{-x}\right)^3$

12. If $f(x)=\frac{x+1}{x-1}$ and $f(a)=5$ then $f(2a)$ is equal to:

(A) 2 (B) 4 (C) 6 (D) 8

13. What is the equation of the directrix for the parabola whose equation is $y^2+8x+6y+25=0$?

(A) $y=3$ (B) $x=2$ (C) $x=0$ (D) $x=4$

14. If $(p \vee q) \Rightarrow (\neg r \wedge r)$ is true, then which one of the following is necessarily true?

(A) $(p \vee r) \Rightarrow q$
(B) $\neg q \wedge r$
(C) $\neg p \Leftrightarrow r$
(D) $\neg p \vee r$

15. The following is the frequency distribution of a grouped data.

Class Intervals	Frequency (f)
3 – 7	2
8 – 12	2
13 – 17	10
18 – 22	6

What is the mean and standard deviation of the distribution, respectively?

(A) 15, $2\sqrt{5}$
(B) 15, $\sqrt{7.5}$
(C) 12.5, $5\sqrt{2}$
(D) 12.5, $\sqrt{15}$

16. If $M = \begin{pmatrix} 0 & 1 & 2 \\ 3 & -1 & 0 \\ 5 & 2 & 4 \end{pmatrix}$ and $A^{T}M = 2I$, where A is a 3×3 matrix and I is the identity matrix of order 3, then what is $\det(A)$?

(A) 0.2 (B) $\frac{4}{17}$ (C) 0.8 (D) $\frac{1}{17}$

17. If $w=\frac{16i}{1+i}+(1-3i)^2$ and $z=|w|+\overline{w}$, which one of the following is the simplest form of z?

(A) $\sqrt{2}+2i$ (C) $4-2i$

(B) $2+2i$ (D) $2-2i$

18. What is the actual value of the sum $\sum_{n=1}^{\infty}\left(\frac{2^n+5^n}{10^n}\right)$?

(A) 0.325 (B) 1 (C) $\frac{5}{4}$ (D) $\frac{37}{9}$

19. Given that $\lim_{x\to 3} f(x)=5$ and $\lim_{x\to 3} g(x)=11$, what is the value of

$$\lim_{x\to 3}\left(\frac{(f(x)-g(x))(g(x)-2f(x))}{g(x)^2-f(x)^2}\right)?$$

(A) $-\frac{66}{96}$ (B) $-\frac{1}{16}$ (C) 0 (D) does not exist.

20. 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 $f'(2)$?

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

21. What is the area of the region between the graphs of $y=-x^2+2$ and $y=|x|$, where $-1\le x\le 2$?

(A) $\frac{11}{6}$ (B) $\frac{25}{6}$ (C) $\frac{7}{3}$ (D) $\frac{11}{3}$

22. What is the derivative of $f(x)=\int_0^{(x^2+\pi)}\frac{dt}{\sin t+1}$?

(A) $\frac{\cos x}{\sin(x^2+\pi)+1}$ (C) $\frac{2x\cos x}{\sin(x^2+\pi)+1}$

(B) $\frac{2x}{\sin(x^2+\pi)+1}$ (D) $\int_0^{2x}\frac{dt}{\sin t+1}$

23. If two lines $y=x$ and $y=x-4$ are tangent to a circle at (2, 2) and (4, 0), respectively, then what is the equation of the circle?

(A) $(x-2)^2+y^2=4$ (C) $(x-3)^2+(y-1)^2=2$

(B) $(x-4)^2+(y-2)^2=4$ (D) $(x-1)^2+(y+1)^2=10$

24. If distinct codes (words) of eight letters are formed by rearranging the letters in the word 'ABBEBAYE', how many of the codes begin with B or Y?

(A) 840 (B) 630 (C) 1680 (D) 420

25. What should be the value of k so that the system of equation

$$\begin{cases} x-y+z=1 \\ -x+5y-4z=1 \\ 2x+2y-z=k \end{cases}$$ has a solution?

(A) 0 (B) 1 (C) −4 (D) 4

26. Let $f(x)=\begin{cases} a\dfrac{\sin x}{x-|x|}, & \text{if } x<0 \\ e^{-x}+\cos x, & \text{if } x\geq 0 \end{cases}$

If f is continuous at $x=0$, then what is the value of a ?

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

27. The simplified form of the derivative of $f(x)=\dfrac{1+\sin x}{\cos x}$ is

(A) $\sec x+\tan x$ (C) $\dfrac{1}{1+\tan x}$

(B) $\dfrac{1+\sin x}{\cos^2 x}$ (D) $\dfrac{\cos x}{\sin^2 x}$

28. Which one of the following is the set of all critical numbers of $f(x)=\frac{1}{3}x^3-|4x-1|$?

(A) $\left\{\frac{1}{4}, 2\right\}$ (C) $\{-2, 2\}$

(B) $\left\{-2, \frac{1}{4}, 2\right\}$ (D) $\left\{\frac{1}{4}\right\}$

29. Which one of the following is equal to $\int_0^{\pi/2}\dfrac{x-\sin x}{\sec x}dx$?

(A) $\dfrac{\pi-3}{2}$ (C) $\dfrac{3-\pi}{2}$

(B) $\dfrac{\pi-1}{2}$ (D) $\dfrac{\pi+3}{2}$

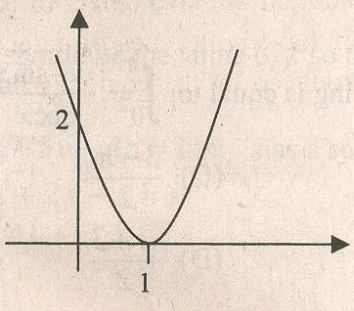
30. Which one of the following is true?
(A) A polynomial can have infinitely many vertical asymptotes.
(B) The graph of a rational function can never cross its horizontal asymptote.
(C) The graph of $f(x)=\dfrac{3x-1}{x-1}$ has no horizontal asymptote.
(D) The graph of $f(x)=\dfrac{x^3-x}{x^2-x}$ has no vertical asymptote.

31. If the equation $(x-2)^2-(y-2)^2=1$ represents a hyperbola, which one of the following represents equation of an asymptote to the hyperbola?
(A) $y=4-x$ (C) $x=2-y$
(B) $x+y=1$ (D) $x+2y=3$

32. What is the sum of the series $\sum_{n=1}^{\infty}(-1)^n 3^{-2n}$?

(A) $\dfrac{-1}{8}$ (B) -0.13 (C) -0.1 (D) $\dfrac{1}{8}$

33. Which of the equations below is represented by the following parabola?



(A) $y=x^2+2$
(B) $y=(2x-1)^2$
(C) $y=2(x-1)^2$
(D) $y=(2x+1)^2$

34. If Q_i , D_i and P_i are respectively the i^{th} - quartile, decile and percentile of a data arranged in an increasing order, then which one of the following is necessarily true ?

(A) $Q_2 = \frac{Q_1 + Q_3}{2}$ (C) $P_{25} > Q_1$

(B) $D_3 > P_{25}$ (D) Q_2 = mean of the data

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

(A) -4 (B) 2 (C) 18 (D) 17

36. If $f(x) = e^{2x}\sin x$, then $f''(x)$ is equal to

(A) $3e^{2x}\sin x - 4e^{2x}\cos x$ (C) $e^{2x}(3\sin x + 4\cos x)$

(B) $4e^{2x}\sin x + 2e^{2x}\cos x$ (D) $e^{2x}(4\sin x - 3\sin x)$

37. 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) $x^2\cos(3x^2) + 6\sin(3x^2)$

38. A company produced 25,000 bulbs and randomly tested 2% of the product. Among the tested bulbs, if 40 have defect of type D_1, 60 have defect of type D_2 and 25 have both types of defects, what is the probability that a bulb produced by the company has **none** of the defects?

(A) 0.95 (B) 0.80 (C) 0.85 (D) 0.20

39. A semi-elliptical arc over a tunnel for a road through a mountain has a major axis of length 80 meters and a height of 30 meters at the center. What is the equation of the semi-elliptical arc over the tunnel, if the center is considered as the origin?

(A) $\frac{x^2}{6400}+\frac{y^2}{900}=1$ (C) $\frac{x^2}{900}+\frac{y^2}{6400}=1$

(B) $\frac{x^2}{1600}+\frac{y^2}{900}=1$ (D) $\frac{x^2}{8100}+\frac{y^2}{6400}=1$

40. Suppose $AX=b$, where A is a 3×3 matrix, $b=(b_1,b_2,b_3)^{\mathrm{T}}$ and $X=(x,y,z)^{\mathrm{T}}$. Which one of the following is necessarily true about this system of linear equations?

(A) The system has a solution only when $\det(A)\neq 0$.

(B) The Cramer's rule is suitable to solve the system if two rows of A are identical.

(C) If $\det(A)\neq 0$ and the second column of A is a multiple of b, then $x=0$.

(D) If $b=\mathbf{0}$, then $X=(0,0,0)^{\mathrm{T}}$ is the only solution of the system.

41. If a box with square base and open top is made from 1,200 cm^2 material, what is the largest volume of the box in cm^3?

(A) 4,000 (B) 8,000 (C) 15,000 (D) 3,000

42. Which one of the following is true about the graph of $f(x)=\frac{x^2-1}{x-x^2}$?

(A) $x=0$ and $x=1$ are its vertical asymptotes.

(B) $y=1$ is its horizontal asymptote.

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

(D) It is almost the same as the horizontal line $y=-1$ as $x\to\pm\infty$.

43. Which one of the following is a valid logical argument?

(A) $p \Rightarrow q,\ q \vdash p$ (C) $\neg p \wedge q,\ q \Rightarrow r \vdash r$

(B) $p \Leftrightarrow q,\ p \Rightarrow q \vdash q$ (D) $\neg p,\ p \vee q,\ r \Rightarrow q \vdash r$

44. If S is a set with 10 elements and $A \subseteq S$, what is the probability that A has 3 or more elements?

(A) $\frac{7}{10}$ (B) $\frac{8}{11}$ (C) $\frac{121}{128}$ (D) $\frac{7}{128}$

45. If $a_n = \left(\frac{n+3}{n+1}\right)^n$, then the limit of the sequence $\{a_n\}_{n=1}^{\infty}$ is equal to:

(A) 1 (B) $\frac{1}{2}e$ (C) e^2 (D) $+\infty$

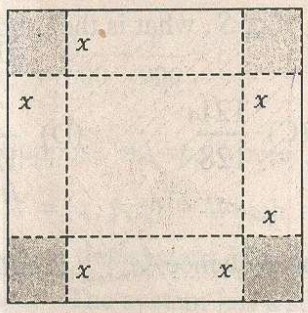
46. Which one of the following is equal to $\lim_{x\to\infty}\left(\frac{x}{x+2}\right)^{-3x}$?

(A) e^6 (B) e^{-3} (C) $e^{-3/2}$ (D) e^{-6}

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

(A) −40 (B) −20 (C) 0 (D) 19

48. Suppose that equal squares are cut from each of the four corners of a square cardboard whose sides are 72 centimeters long. [See the figure below.] The resulting flaps are then folded up to form a box without a top. How long should be each of the four squares that has to be cut off to maximize the volume of the box?



(A) 6 cm

(B) 12 cm

(C) 15 cm

(D) 24 cm

49. 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 $x = 3$?

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

50. Which one of the following is equal to $\int \frac{x + \ell n(x+1)}{(x+1)^2} dx$?

(A) $\ell n(x+1) + \frac{x}{x+1} + c$

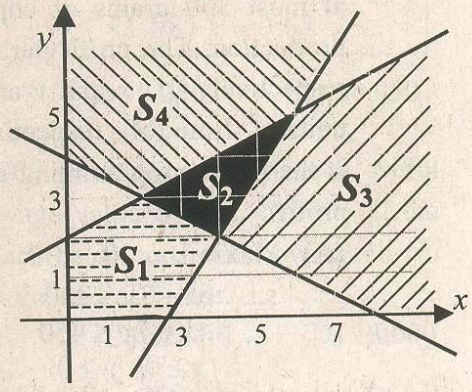
(B) $(x+1)^2 + \frac{1}{x+1} + c$

(C) $(x+1)^2 - \frac{1}{x+1} + c$

(D) $\frac{x\ell n(x+1)}{x+1} + c$

51. S_1, S_2, S_3 and S_4 represent the respective regions shown in the figure below. Which one of these regions is the solution region of the following system of inequalities

$$\begin{cases} 3x-2y \le 8 \\ x+2y \ge 8 \\ -x+2y \ge 4 \\ x \ge 0,\ y \ge 0 \end{cases} ?$$



(A) S_1 (C) S_3

(B) S_2 (D) S_4

52. The mean systolic blood pressure was found to be 127.4 and 135.6 mm Hg for two groups of 12 and 18 men, respectively. What is the mean systolic blood pressure of all the 30 men in mm Hg?

(A) 131.5 (B) 132.3 (C) 131. 8 (D) 132.8

53. A publishing company has purchased a new machine at a cost of Birr 12, 000. The machine has a useful life of 8 years. If the salvage value at the end of 8 years is Birr 2, 000, what is its book value at the end of its 5^{th} year?

(A) Birr 6, 820 (C) Birr 4, 750

(B) Birr 5, 685 (D) Birr 3, 925

54. If an item is sold for Birr 240 with 40% discount, what was its original selling price in Birr?

(A) 336 (B) 280 (C) 400 (D) 420

55. A manufacturer produces two alloys A_1 and A_2 by mixing copper and zinc. Each unit of A_1 is produced by mixing 6 grams of copper and 4 grams of zinc. Similarly, a unit of A_2 is a mixture of 3 grams of copper and 7 grams of zinc. The manufacturer can use at most 300 grams of copper and 450 grams of zinc for the production. The profit per unit of A_1 and A_2 is Birr 30 and 20, respectively. If x and y are decision variables representing the units of A_1 and A_2, respectively, then which one of the following is the linear programming model for the problem of maximizing profit?

(A) Maximize $20x+30y$
s.t. $6x+3y\le 300$
$4x+7y\le 450$
$x\ge 0,\ y\ge 0$

(B) Maximize $30x+20y$
s.t. $6x+4y\le 300$
$3x+7y\le 450$
$x\ge 0,\ y\ge 0$

(C) Maximize $30x+20y$
s.t. $6x+3y\le 300$
$4x+7y\le 450$
$x\ge 0,\ y\ge 0$

(D) Maximize $30x+20y$
s.t. $6x+3y\ge 300$
$4x+7y\ge 450$
$x\ge 0,\ y\ge 0$

56. What is the maximum value of $z=3x-2y$ on S, where $S=\{(x,y)\mid x+y\ge 2,\ \ 2x-y\le 4,\ \ -x+2y\le 4\}$?

(A) 12 (B) 6 (C) 4 (D) 8

57. If you want to earn an annual rate of 10 % on your investments, how much (to the nearest cents) should you pay for a note that will be worth Birr 5,000 in 9 months?

(A) Birr 6, 163.10
(B) Birr 5, 261.21
(C) Birr 4, 651.16
(D) Birr 3, 983.25

58. What is the amount (in Birr) that must be deposited now so that it will be worth Birr 15,000 after 5 years in a bank that pays 8% interest per annum compounded quarterly?

Given:	$(1.02)^5 = 1.10$;	$(1.02)^{-20} = 0.67$;
	$(1.08)^5 = 1.47$,	$(1.08)^{-5} = 0.68$

(A) 11,250 (B) 11,025 (C) 10,250 (D) 10,050

59. A machine costing Birr 280,000 is estimated to have a useful lifetime of 15 years and a salvage value of Birr 40,000. If the rate of depreciation of the machine is constant, how much (in Birr) will the machine worth at the end of 5 year?
(A) 18,400 (B) 200,000 (C) 22,400 (D) 18,000

60. A merchant had bought an item for Birr 250 last year and sold it this year with 12% increase on its selling price of last year. If the mark-up percent on the item with respect to cost was 20% last year, for how much (in Birr) did he sell the item this year?
(A) 320 (B) 300 (C) 380 (D) 336

61. A salesperson earns a monthly salary of Birr 1,500 plus commission depending on the level of monthly sales as follows:
- 1% of sales between Birr 50,001 and 150,000
- 2% of sales between Birr 150,001 and 250,000; and
- 5% of all sales above Birr 250,000.

If the sale in a month is Birr 220,000, how many Birr does the salesperson earn in the month?

(A) 3,500 (C) 3,900
(B) 4,500 (D) 3,850

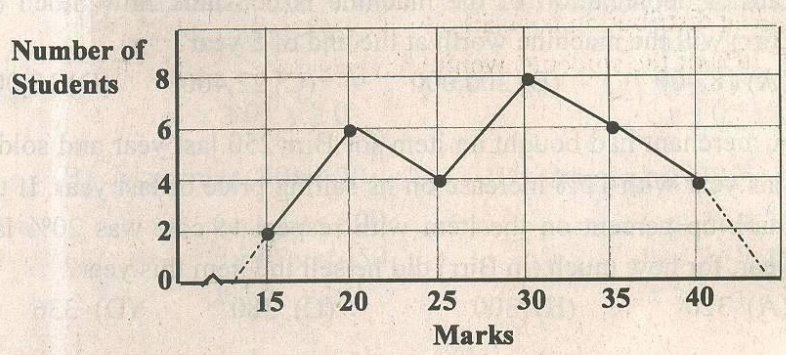
62. Suppose that you invested Birr 1, 000 in a bank at an interest rate of 8%. If there are two interest payment periods per year, what is the amount you own after 5 years?

[You may use the information
$(1.08)^5 = 1.469328$, $(1.04)^{10} = 1.48024$ $(1.02)^{20} = 1.485947$*]*

(A) Birr 1, 469.33 (C) Birr 1, 485.95

(B) Birr 1, 480.24 (D) Birr 1, 489.85

63. Marks scored by students in a test are grouped into six class intervals of equal width and represented by the following frequency polygon.



What is the median (m_d) and mode (m_0) of the marks, respectively?

(A) $m_d = 27.5$, $m_0 = 30$ (C) $m_d = 29.4$, $m_0 = 30$

(B) $m_d = 27.5$, $m_0 = 30.8$ (D) $m_d = 29.4$, $m_0 = 30.8$

64. A savings and a loan wants to offer a certificate of deposit with a monthly compounding rate that has an effective rate of 4%. What annual nominal rate compounded monthly should they use?

[You may use the information :
$(1.04)^{\left(\frac{1}{12}\right)} = 1.003273$, $(1.04)^{12} = 1.601032$ *]*

(A) 3.9% (B) 4.8% (C) 5.2% (D) 7.2%

65. The following is the frequency distribution of weight (in kg) of students grouped into five class intervals.

Class Intervals	48–52	53–57	58–62	63–67	68–72
Frequency (f)	9	15	20	10	6

Which of the following can be inferred from this frequency distribution?

(A) The inter-quartile range of the distribution is 9.5.
(B) The median weight is 60 kg.
(C) The distribution is positively skewed.
(D) 75% of the students weigh above 54.5 kg.

THE END