

Instruction: Answer all the questions in Section A and any 4 in Section B.

Subject: Further Mathematics

Time: 2 hr. 35min.

Section A

- The fourth term of a geometric sequence is 2 and the sixth term is 8. Find the common ratio.
A. ± 1 B. ± 2 C. ± 3 D. ± 4 E. ± 5
 - Solve $3x - 4 > 8$ A. $x > 4$ B. $x < 2$ C. $x < -3$ D. $x < 2$ E. $x < -1$
 - Evaluate $\log_{\sqrt{2}} 4 + \log_{\frac{1}{2}} 16 - \log_4 32$ A. -5.5 B. -2.5 C. 2.5 D. 5.5 E. 3.7
 - Find the next two terms of the sequence: 1, 5, 14, 30, 55, A. 61, 110 B. 67, 116 C. 81, 140 D. 91, 140 E. 37, 112
 - The sum of the first two terms of an AP is 24. The sum of the 4th and 5th terms is 36. Find the common difference. A. 6 B. 4 C. 2 D. -2 E. 5
 - Solve the equation $\log_2(x - 1) + \log_2(x + 2) = 2$ A. $x=0$ or 1 B. $x=1$ or -2 C. $x=2$ or -3 D. $x = \frac{1}{2}$ or 0 E. $x=2$ or -5
 - If $f: x \rightarrow x^2 + 2$ and $g: x \rightarrow 2x + 2$, find $f^{-1}g(2)$. A. $\frac{1}{2}$ B. 2 C. 4 D. 36 E. 38
- The table below shows the ages of students in a club. Use it to answer questions 8, 9 and 10.

Age (Years)	13	14	15	16	17
Frequency	10	24	8	5	3

- How many students are in the club? A. 50 B. 55 C. 65 D. 60 E. 27
- Find the modal age. A. 13 B. 12 C. 16 D. 15 E. 14
- Calculate the median age. A. 14 B. 15 C. 16 D. 13 E. 12
- The 17th term of the series -3, -1, 2, 6 is A. 149 B. 139 C. 129 D. 119 E. 315
- If $\log_2(3x - 1) = 5$, find x . A. 2.00 B. 3.67 C. 8.67 D. 11.00 E. 8.00
- If $f: x \rightarrow \frac{4x-1}{3}$, where $x \in \mathbb{R}$, find $f^{-1}(-2)$ A. -3 B. $-\frac{5}{4}$ C. $-\frac{4}{5}$ D. $-\frac{5}{4}$ E. $-\frac{1}{3}$
- If $\sqrt{72} + \sqrt{32} - 3\sqrt{18} = x\sqrt{8}$, find the value of x . A. 1 B. $\frac{3}{4}$ C. $\frac{1}{2}$ D. $\frac{1}{4}$ E. -2
- Solve $4(2^{x^2}) = 8^x$. A. 1 and 2 B. 1 and -2 C. -1 and 2 D. -1 and -2 E. 2 and 3
- If $P = \{x : 1 \leq x \leq 6\}$ and $Q = \{x : 2 < x < 9\}$, where $x \in \mathbb{R}$, find $P \cap Q$.
A. $\{x : 2 \leq x \leq 6\}$
B. $\{x : 2 \leq x < 6\}$ C. $\{x : 2 < x < 6\}$ D. $\{x : 2 < x \leq 6\}$ E. $\{x : 1 < x \leq 4\}$
- If the domain of $f: x \rightarrow x^2 - 2$ is $\{-2, -1, 0, 1\}$, find its range. A. $\{2, 1, 0, -1\}$ B. $\{2, -1, -2\}$ C. $\{0, -1, -2\}$ D. $\{2, 1, -2, -1\}$ E. $\{3, 4, -2, -3\}$
- Solve the inequality $y + 9 > 5y - 7$ A. $y > 4$ B. $y > -4$ C. $y < 4$ D. $y < -4$ E. $y < 2$
- A binary operation $*$ is defined on the set \mathbb{R} , of real numbers by $a * b = \frac{ab}{4}$. Find the value of $\sqrt{2} * \sqrt{6}$
A. $\sqrt{3}$ B. $\frac{3\sqrt{3}}{4}$ C. $\frac{\sqrt{3}}{2}$ D. $\frac{\sqrt{2}}{2}$ E. $\frac{\sqrt{5}}{3}$
- Evaluate $\log_{0.25} 8$. A. $\frac{3}{2}$ B. $\frac{2}{3}$ C. $-\frac{2}{3}$ D. $-\frac{3}{2}$ E. $-\frac{1}{4}$
- The sum of the first 2 terms of an A.P is 24. The sum of the 4th and 5th terms is 36. Find its common difference. A. 6 B. 4 C. 2 D. -2 E. 7
- A binary operation $*$ is defined on the set of real numbers, \mathbb{R} , by $a * b = a + b - 1$. Find the Identity element under the operation $*$. A. -1 B. 0 C. 1 D. 2 E. -3
- Solve $9^{2x+1} = 81^{3x+2}$. A. $-\frac{3}{4}$ B. $-\frac{2}{3}$ C. $\frac{4}{5}$ D. $\frac{3}{2}$ E. $\frac{3}{7}$
- Given that $(\sqrt{3} - 5\sqrt{2})(\sqrt{3} + \sqrt{2}) = p + q\sqrt{6}$, find q . A. 4 B. -4 C. -5 D. -7 E. 2
- Two functions f and g are defined by $f: x \rightarrow 3x - 1$ and $g: x \rightarrow 2x^3$, evaluate $fg(-2)$. A. -49 B. -47 C. -10 D. -9 E. -7
- The following are marks obtained by a student in Further Mathematics test: 80, 79, 60, 53, 72, 42, 61, 55, 49, 75 and 69. Find the range of the marks. A. 38 B. 56 C. 71 D. 41 E. 11
- Solve the equation $4^{x+1} = 8^x$. A. $x = -2$ B. $x = 0$ C. $x = \frac{1}{2}$ D. $x = 1$ E. $x = 2$
- The operation $*$ on the set Q of rational numbers is defined by $a * b = \frac{a^2 + b^2 - 2ab}{3}$, $a, b \in \theta$. Determine $\frac{2}{3} * \frac{-1}{2}$. A. $-\frac{11}{18}$ B. $\frac{-11}{18}$ C. $\frac{11}{54}$ D. $\frac{11}{18}$ E. 2
- In a class of 60 students, 50 offer Biology and 40 offer Physics. If 5 do not offer the two subjects, how many students offer both subjects? A. 10 B. 20 C. 35 D. 45 E. 75
- A binary operation $*$, is defined on the set \mathbb{R} , of real numbers by $a * b = a^2 + b + ab$. Find the value of x for which $5 * x = 37$. A. 7 B. 2 C. -2 D. -7 E. 5

Use the information below to answer questions 32 to 36.

- Let $E = \{1, 2, 3, 4\}$, $P = \{2, 3\}$, $Q = \{2, 4\}$ and $R = \{\emptyset\}$
32. Find R' A. $\{1, 2, 3, 4\}$ B. $\{2, 3\}$ C. $\{2, 4\}$ D. $\{\emptyset\}$ E. $\{3, 4\}$
33. Find $R \cap E$ A. $\{1, 2, 3, 4\}$ B. $\{2, 3\}$ C. $\{2, 4\}$ D. $\{\emptyset\}$ E. $\{1\}$
34. Find $P \cap Q$ A. $\{1, 3, 4\}$ B. $\{2, 3, 4\}$ C. $\{1, 4\}$ D. $\{2\}$ E. $\{1, 3\}$
35. What is $(P \cap Q)'$? A. $\{1, 3, 4\}$ B. $\{1, 2, 3\}$ C. $\{1, 2\}$ D. $\{2\}$ E. $\{2, 4\}$
36. Determine $P \cup Q$ A. $\{1, 2, 3, 4\}$ B. $\{2, 3, 4\}$ C. $\{1, 2, 3\}$ D. $\{1, 2, 3, 4, 5\}$ E. $\{1, 2\}$
37. Determine the third term of a geometrical progression whose first and the fourth terms are 4 and 108 respectively. A. 112 B. 218 C. 36 D. 27 E. 3
38. The functions f and g are defined on the set, R of real numbers by $f: x \rightarrow x^2 - x - 6$ and $g: x \rightarrow x - 1$. Find $f \circ g(3)$. A. -8 B. -6 C. -4 D. -3 E. -1
39. The sum S_n of a sequence is given by $S_n = 2n^2 - 5$. Find the 6th term. A. 112 B. 67 C. 45 D. 22 E. 13
40. Simplify $\sqrt{(-\frac{1}{64})^{-\frac{2}{3}}}$ A. -4 B. $-\frac{1}{4}$ C. $\frac{1}{8}$ D. 4 E. 7
41. If $P = \{x : 1 \leq x \leq 6\}$ and $Q = \{x : 2 < x < 9\}$, where $x \in R$, find $P \cap Q$. A. $\{x : 2 \leq x \leq 6\}$
B. $\{x : 2 \leq x < 6\}$ C. $\{x : 2 < x < 6\}$ D. $\{x : 2 < x \leq 6\}$ E. $\{x : 2 < x \leq 4\}$
42. Simplify $8^{2n} \times 2^{2n} + 4^{3n}$ A. 2^{-n} B. 2^{1-n} C. 2^{2n} D. 2^{n+1} E. 2^{n-2}
43. Evaluate $\frac{(-9) \times (-8) \times (-2)}{-8 + 3 \times 6}$ A. $14\frac{2}{3}$ B. $4\frac{4}{5}$ C. $-4\frac{4}{5}$ D. $-10\frac{1}{5}$ E. $-14\frac{2}{5}$
44. Simplify $0.87345 \div 0.004$ giving your answer to two significant figures.
A. 218.36 B. 21.84 C. 220 D. 218.35 E. 218
45. Express 68464 to three significant figures. A. 68400 B. 68460 C. 68500 D. 684.64 E. 685
46. Solve this equation: $5x + 5 = 26 + 2x$ A. 4 B. 5 C. 6 D. 7 E. 2
47. Find the difference between the median and the mode of the set of numbers 7, 4, 9, 5, 6, 7, 8, 7, 4, 6, 5 A. -1 B. 2 C. 5 D. 1 E. 3
49. Simplify $36^{\frac{1}{2}} \times 64^{-\frac{1}{3}} \times 5^0$ A. 0 B. $\frac{1}{24}$ C. $\frac{2}{3}$ D. $1\frac{1}{2}$ E. $7\frac{1}{2}$
50. Express $129/100$ as a mixed fraction. A. $12\frac{9}{100}$ B. $10\frac{9}{100}$ C. $1\frac{29}{100}$
D. $6\frac{9}{100}$ E. $21\frac{29}{100}$

(25 Marks)

Section B

Answer any four (4) questions from this section

1. Show graphically the region R which satisfies the set of inequalities: $2x + 3y \leq 26$, $x + 2y \leq 16$, $x \geq 0$, $y \geq 0$. (10 Marks)
2. (a) Given $\sin \theta = \frac{5}{13}$ and θ is acute, find: (i) $\cos \theta$ (ii) $\tan \theta$
(b) Use table to evaluate each of the following: (i) $\cos 115^\circ$ (ii) $\sin 245^\circ$ (iii) $\tan 125^\circ$
(10 Marks)
3. The first and last term of an A.P are -12 and 40 respectively. If the sum of the sequence is 196, find the:
(a) number of terms,
(b) common difference,
(c) 12th term. (10 Marks)
4. (a) Prove that $\frac{1}{1+\cos\theta} + \frac{1}{1-\cos\theta} = 2\operatorname{cosec}^2\theta$
(b) Find the 8th term of a geometric progression whose first term is 3 and common ratio is 2. (10 Marks)
5. (a) If $f(x) = x^2$ and $g(x) = 2x - 1$, find: (i) gf (ii) fg .
(b) Given the function $f(x) = 5x - 2$, find $f^{-1}(-1)$. (10 Marks)