2018
MATRICULATION EXAMINATION
DEPARTMENT OF MYANMAR EXAMINATION

MATHEMATICS **Time Allowed: (3) Hours**

WRITE YOUR ANSWERS IN THE ANSWER BOOKLET.

SECTION (A)

(Answer **ALL** questions. Choose the correct or the most appropriate answer for each question. Write the letter of the correct or the most appropriate answer.)

1. (1) If $f(x) = 3x + 1$ and $g(x) = 2x^2 - 3$, then $(g \circ f)(2) =$
A. 91 B. 93 C. 95 D. 97 E. 99

(2) An operation $\odot$ is defined by $a \odot b = a^2 + b^2$. Then $(2 \odot 3)(1 \odot 2) =$
A. 8 B. -8 C. 18 D. -18 E. 65

(3) The remainder when $2x^3 + 3x^2 - 6x - 4$ is divided by $2x + 3$ is
A. 2 B. -2 C. 4 D. -5 E. 5

(4) $x - 2$ is a factor of $x^{n+2} + 5x^n - 10x - 52$. Then $n =$
A. 2 B. 3 C. 4 D. 5 E. 6

(5) If $(2 + 3x)^{2018} = c_0 + c_1x + c_2x^2 + c_3x^3 + \cdots + c_{2018}x^{2018}$,
then $c_0 - c_1 + c_2 - c_3 + \cdots + c_{2018} =$
A. 2018 B. 2019 C. 1 D. -1 E. 0

(6) In the expansion of $(1 + ax)^{24}$ where $a > 0$, the coefficient of x^2 is 1104, then $a =$
A. 2 B. -2 C. $-\frac{1}{2}$ D. $\frac{1}{2}$ E. 4

(7) The solution set of the inequation $x^2 - 2 > 7$ is
A. $\{x \mid x > 3\}$ B. $\varnothing$ C. R D. $\{x \mid x < -3 \text{ or } x > 3\}$ E. $\{x \mid -3 < x < 3\}$

(8) In an A.P., $u_1 = 2$, $u_{n+1} = u_n + \frac{1}{2}$, then $S_n =$
A. $\frac{n+1}{2}$ B. $\frac{n+3}{2}$ C. $\frac{n-1}{2}$ D. $\frac{n^2+3n}{4}$ E. $\frac{n^2+7n}{4}$

(9) The fourth, seventh and tenth terms of a G.P. are a, b, c respectively, then
A. $a^2 = b^2 + c^2$ B. $b^2 = ac$ C. $a^2 = bc$ D. $a = bc$ E. none of these

(10) Given that three consecutive terms of a G.P. are 3^{x+3}, 9^x and 729. Then $x =$
A. 4 B. 3 C. 2 D. 1 E. 5

(11) If $A = \begin{pmatrix} 1 & a^2 \\ 2a+3 & 1 \end{pmatrix}$, $A = A'$ and A is non-singular, then $a =$
A. 3 or -1 B. -3 or 1 C. 3 only D. -1 only E. 1 only

(12) If $P = \begin{pmatrix} 2 & 0 \\ 4 & 2 \end{pmatrix}$ and $\det(xP') = 16$, then $x =$
A. 2 B. ± 2 C. 4 D. ± 4 E. 16

[P. T. O.

(13) If any number is chosen at random from the whole numbers 1 to 60 inclusive, the probability of getting a prime number is

A. $\frac{7}{30}$ B. $\frac{1}{4}$ C. $\frac{4}{15}$ D. $\frac{17}{60}$ E. $\frac{3}{10}$

(14) A die is rolled x times. If the expected frequency of a number which is divisible by 3 is 60, then the expected frequency of a number not less than 3 is

A. 120 B. 180 C. 90 D. 60 E. 30

(15) Chords AB and CD of a circle intersect at P within the circle. If AP = x, PB = x – 2, CP = 8 and PD = 3, then x =

A. 2 B. 3 C. 4 D. 5 E. 6

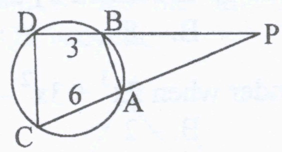
(16) ABCD is a cyclic quadrilateral. If $\angle A = 125°$ and $\angle B = 45°$, then $\angle D - 2\angle C =$

A. 25° B. 30° C. 45° D. 50° E. 55°

(17) In the figure, if $\alpha(\Delta PAB) : \alpha(\Delta PCD) = 1 : 4$, AC = 6 and BD = 3, then AP =

A. 2.5 B. 3.5 C. 2

D. 3 E. 4



(18) The position vectors, relative to an origin O, of the points A and B are $\begin{pmatrix}2\\7\end{pmatrix}$ and $\begin{pmatrix}5\\3\end{pmatrix}$ respectively. Then the unit vector parallel to $\overrightarrow{AB}$ is

A. $\begin{pmatrix}3\\-4\end{pmatrix}$ B. $\begin{pmatrix}-3\\4\end{pmatrix}$ C. $\frac{1}{5}\begin{pmatrix}3\\-4\end{pmatrix}$ D. $\pm\frac{1}{5}\begin{pmatrix}3\\-4\end{pmatrix}$ E. $-\frac{1}{5}\begin{pmatrix}3\\-4\end{pmatrix}$

(19) The map of the point (3, 4) by reflection matrix about the Y-axis is

A. (3, 4) B. (4, 3) C. (– 3, 4) D. (3, – 4) E. none of these

(20) $\cos^2\frac{\pi}{3} + \sin^2\frac{2\pi}{3} + 2\cot^2\frac{3\pi}{4} =$

A. 2 B. – 2 C. 3 D. – 3 E. 4

(21) sin 180° + sin 30° =

A. 0.5 B. – 0.5 C. 1 D. 1.5 E. – 1.5

(22) $\sin(\alpha+\beta) - \sin(\alpha-\beta) =$

A. $2\sin\alpha\cos\beta$ B. $2\cos\alpha\sin\beta$ C. $2\cos\alpha\cos\beta$ D. $2\sin\alpha\sin\beta$ E. $-2\sin\alpha\sin\beta$

(23) The gradient of the tangent to the curve $3xy - y^2 = x - 1$ at the point (0, – 1) is

A. 2 B. – 2 C. 1 D. – 1 E. 3

(24) The stationary point of the curve $y = 2x + \frac{1}{x^2}$ is at x =

A. 1 B. – 1 C. 2 D. – 2 E. ±1

(25) $\frac{d}{dx}(\sin x - \cos x)^2 =$

A. 2sin 2x B. – 2sin 2x C. 2cos 2x D. – 2cos 2x E. 2sin x – 2cos x

(25 marks)

SECTION (B)

(Answer **ALL** questions)

2. If $f(x) = px^2 + 1$ where p is a constant and $f(3) = 28$, find the value of p. Find also the formula of $f \circ f$ in simplified form. (3 marks)

(OR)

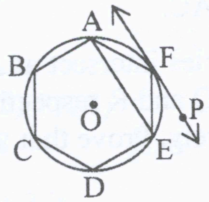
The expression $x^3 - 2x^2 - kx + 6$ and $x^3 + x^2 + (8 - k)x + 10$ have the same remainder when divided by $x + a$. Show that $3a^2 - 8a + 4 = 0$. (3 marks)

3. If x, y, z is a G.P., show that log x, log y, log z is an A.P. (3 marks)

(OR)

If log x, log y, log z is an A.P., show that x, y, z is a G.P. (3 marks)

4. Given : ABCDEF is an inscribed regular hexagon.
PF is a tangent to the circle O at F.
Prove : PF and EA are parallel. (3 marks)



5. Prove that $\dfrac{1-\cos 2x+\sin 2x}{1+\cos 2x+\sin 2x} = \tan x$. (3 marks)

6. Evaluate $\lim\limits_{x \to 1} \dfrac{x^4 - 1}{x^3 - 1}$ and $\lim\limits_{x \to 0} \dfrac{\frac{1}{x-1} + \frac{1}{x+1}}{x}$. (3 marks)

SECTION (C)

(Answer any **SIX** questions)

7.(a) Let $f : R \to R$ and $g : R \to R$ be defined by $f(x) = x + 7$ and $g(x) = 3x - 1$. Find $(f^{-1} \circ g)(x)$ and $(g^{-1} \circ f)(x)$. What are the values of $(f^{-1} \circ g)(3)$ and $(g^{-1} \circ f)(2)$? (5 marks)

(b) A binary operation $\odot$ on R is defined by $x \odot y = (x + 2y)^2 - 3y^2$. Show that the binary operation is commutative. Find the possible values of k such that $(k - 3) \odot (k + 2) = 25$. (5 marks)

8.(a) Given $f(x) = x^3 + px^2 - 2x + 4\sqrt{3}$ has a factor $x - 2\sqrt{3}$, find the value of p. Show that $x + \sqrt{2}$ is also a factor and solve the equation $f(x) = 0$. (5 marks)

(b) Use the binomial theorem to find the value of $(x + \sqrt{x^2 - 1})^6 + (x - \sqrt{x^2 - 1})^6$. (5 marks)

9.(a) Find the solution set of the inequation $5x^2 < 18x + 8$ by graphical method and illustrate it on the number line. (5 marks)

(b) An A.P. contains 25 terms. The last three terms are $\dfrac{1}{x-4}, \dfrac{1}{x-1}$ and $\dfrac{1}{x}$. Calculate the value of x and the sum of all the terms of the progression. (5 marks)

10.(a) If a, b, c be in A.P., and if u, v be the A.M. and G.M. between a and b, x, y the A.M. and G.M. between b and c, then prove that $u^2 - v^2 = x^2 - y^2$. (5 marks)

(b) Solve the matrix equation $\begin{pmatrix} -2 & 3 \\ 1 & -4 \end{pmatrix} X = \begin{pmatrix} -3 & -5 \\ -16 & -20 \end{pmatrix}$.

Hence find x and y, if $X = \begin{pmatrix} x+2y & 16 \\ 7 & 2x-y \end{pmatrix}$. (5 marks)

[P. T. O.

11.(a) Find the inverse of the matrix $\begin{pmatrix} 4 & 3 \\ 7 & 6 \end{pmatrix}$, and use it to solve the system of equations

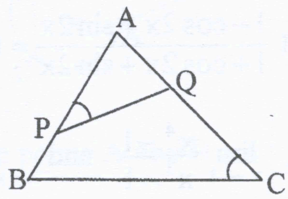
$$7x + 6y + 16 = 0$$
$$3y + 4x + 7 = 0.$$
(5 marks)

(b) How many 3-digit numerals can you form from 3, 0, 1 and 6 without repeating any digit? Find the probability of an even number and find the probability that a numeral which is divisible 3. (5 marks)

12.(a) If A, B, C are three points on the circumference of a circle such that the chord AB is equal to the chord AC, prove that the tangent at A bisects the exterior angle between AB and AC. (5 marks)

(b) Two circles intersect at A and B. A point P is taken on one so that PA and PB cut the other at Q and R respectively. The tangents at Q and R meet the tangent at P in S and T respectively. Prove that $\angle TPR = \angle BRQ$ and PBQS is cyclic. (5 marks)

13.(a) In the figure $\angle APQ = \angle C$, $AP : PB = 3 : 1$ and $AQ : QC = 1 : 2$. If $AQ = 2$, find the length of AP and the ratios of $\alpha(\Delta APQ) : \alpha(\Delta ABC)$ and $\alpha(\Delta APQ) : \alpha(BCQP)$.



(5 marks)

(b) Points A and B have position vectors $\begin{pmatrix} 5 \\ 1 \end{pmatrix}$ and $\begin{pmatrix} 3 \\ 4 \end{pmatrix}$ respectively, relative to an origin O.

Given that point C with position vector $\begin{pmatrix} 0 \\ k \end{pmatrix}$ lies on AB produced, calculate the value of k and the value of $|2\overrightarrow{AB} + \overrightarrow{OC}|$. (5 marks)

14.(a) If $\alpha + \beta + \gamma = 180°$, show that $\cos\frac{\alpha}{2} + \cos\frac{\beta}{2} + \cos\frac{\gamma}{2} = 4\cos\frac{\beta+\gamma}{4}\cos\frac{\gamma+\alpha}{4}\cos\frac{\alpha+\beta}{4}$.

(5 marks)

(b) In ΔABC, $c = 10$, $b = 6$ and $a = 5$. Check whether $\angle ACB$ is acute or obtuse and find its magnitude. (5 marks)

15.(a) Given that $y = \sin(\sin x)$, prove that $\frac{d^2y}{dx^2} + \tan x\frac{dy}{dx} + y\cos^2 x = 0$. (5 marks)

(b) Show that the point $(0, \pi)$ lies on the curve $x^2\cos^2 y = \sin y$. Then find the equations of tangent and normal to the curve at the point $(0, \pi)$. (5 marks)
