



C09-A-102/C09-AA-102/C09-AEI-102/C09-BM-102/
C09-C-102/C09-CM-102/C09-CH-102/C09-CHPC-102/
C09-CHPP-102/C09-CHOT-102/C09-CHST-102/
C09-EC-102/C09-EE-102/FW-102/C09-IT-102/
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3002

BOARD DIPLOMA EXAMINATION, (C-09)

APRIL/MAY—2015

FIRST YEAR (COMMON) EXAMINATION

ENGINEERING MATHEMATICS—I

Time : 3 hours]

[Total Marks : 80

PART—A

3×10=30

Instructions : (1) Answer **all** questions.

(2) Each question carries **three** marks.

(3) Answers should be brief and straight to the point and shall not exceed *five* simple sentences.

1. If $x = \frac{1}{3}$, find the value of $x^3 - \frac{1}{x^3}$.

2. Rationalize the denominator of $\frac{\sqrt{7} - \sqrt{3}}{\sqrt{7} + \sqrt{3}}$.

3. If $A + B + C = 180^\circ$, prove that $\cot A \cot B + \cot B \cot C + \cot C \cot A = 1$

4. Resolve $\frac{1}{(x-1)(x-2)}$ into partial fractions.

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5. Show that *

$$\frac{\cot \tan}{\cot \tan} = \sec^2$$

6. Find the modulus of $\frac{5 + 12i}{2 - 3i}$.

7. Find the equation of the straight line passing through the point (3, -4) and perpendicular to the line $5x - 3y - 1 = 0$.

8. Find the equation of the point circle with centre (-5, 2).

9. Evaluate :

$$\lim_{x \rightarrow 0} \frac{\sin 5x}{\sin 3x}$$

10. Differentiate $e^x \sin 4x$.

PART—B

10×5=50

Instructions : (1) Answer *any five* questions.

(2) Each question carries **ten** marks.

(3) Answers should be comprehensive and the criterion for valuation is the content but not the length of the answer.

11. (a) Using Laplace's expansion, evaluate

$$\begin{vmatrix} a & b & c \\ c & a & b \\ b & c & a \end{vmatrix}$$

(b) Find the adjoint of

$$\begin{vmatrix} 7 & 8 & 11 \\ 10 & 10 & 10 \\ 1 & 4 & 3 \end{vmatrix}$$

12. (a) If $A + B + C = 180^\circ$, show that

$$\sin 2A + \sin 2B + \sin 2C = 4 \cos A \sin B \cos C$$

(b) Prove that $\tan^{-1} \frac{2}{3} + \cot^{-1} \frac{4}{3} = \tan^{-1} \frac{17}{6}$.

13. (a) Solve $1 - 8 \cos^2 \theta + 4 \sin^2 \theta = 0$.
- (b) In any $\triangle ABC$, show that $\frac{\sin A}{a} = \frac{3}{2R}$.
14. (a) Find the vertex, focus and directrix of the parabola $(y - 3)^2 = 12(x - 1)$.
- (b) Find the equation of the ellipse which passes through the points $(1, -2)$ and $(3, -1)$ with axes as coordinate axes.
15. (a) Find the equation of the rectangular hyperbola whose focus is $(-1, -3)$ and directrix is $2x - y - 1 = 0$.
- (b) Find the perimeter and centroid of the triangle formed by the points $(4, 3, 2)$, $(1, -1, 3)$ and $(5, 4, 6)$.
16. (a) Find $\frac{dy}{dx}$, if $x = a(\sin \theta)$, $y = a(1 - \cos \theta)$.

(b) If

$$y = \sqrt{\sin x} \sqrt{\sin x} \sqrt{\sin x} \dots \text{to } \infty$$

show that

$$\frac{dy}{dx} = \frac{\cos x}{2y - 1}$$

17. (a) For any curve, show that

$$\frac{\text{subtangent}}{\text{subnormal}} = \frac{\text{length of tangent}^2}{\text{length of normal}}$$

(b) Each side of a square increases at the rate of 2 cm/sec. Find the rate at which the area of the square increases when the side is 18 cm. Also find the rate at which perimeter increases.

18. (a) Find the dimensions of a rectangle of maximum area having a perimeter of 24 ft.

(b) If there is an error of 1% in measuring the side of a square plate, find the percentage error in its area.
