



Mathematics

- (a) Show that the equation of the ellipse whose foci are z_1, z_2 and major axis $2a$, can be put in the form $|z - z_1| + |z - z_2| = 2a$. Find its eccentricity.

(b) Find the three cube roots of unity.
- (a) If the roots of the equation $ax^2 + bx + c = 0$ be in the ratio $m : n$ prove that

$$\sqrt{\frac{m}{n}} + \sqrt{\frac{n}{m}} + \frac{b}{\sqrt{ac}} = 0$$

(b) If x is real, show that $\frac{x^2 + 34x - 71}{x^2 + 2x - 7}$ can not lie between 5 and 9.
- (a) Find the general solution of the Trigonometric equation $\tan \theta + \cot \theta = \frac{4}{\sqrt{3}}$

(b) The horizontal distance between two towers is 60 m. The angular elevation of the top of the taller tower as seen from the top of the shorter one is 30° . If the height of the taller tower is 150 m, find the height of the shorter one.
- (a) prove that

$$\lim_{x \rightarrow \infty} \frac{(3x-1)(2x+5)}{(x-3)(3x-7)} = 2$$

(b) Show that $f(x) = \frac{1}{1+e^{\frac{1}{x}}}$ when $x \neq 0$
Is not continuous when $x = 0$.
- (a) Given that $y = \log_{10} \sin x$, find $\frac{dy}{dx}$

(b) Find the derivative of $\cot^{-1} \left(\frac{1+x}{1-x} \right)$ with respect to x .
- (a) Evaluate $\int \sin^{-1} x dx$

(b) Show that $\int_{\pi/2}^{\pi/2} \sin|x| dx = 2$
- (a) if $\vec{a}, \vec{b}, \vec{c}$ are non-null vectors and \vec{a} is not parallel to \vec{b} and \vec{c} is not Perpendicular to plane containing \vec{a} and \vec{b} then show that

$$(\vec{a} \times \vec{b}) \times \vec{c} = (\vec{c} \cdot \vec{a}) \cdot \vec{b} - (\vec{c} \cdot \vec{b}) \cdot \vec{a}$$

(b) Determine a unit vector perpendicular to each of the vectors

$$4\vec{i} - 2\vec{j} + 3\vec{k} \text{ and } 45\vec{i} + \vec{j} - 4\vec{k}$$
- (a) Find the focus, vertex and directrix of the parabola $y^2 - 2x - 6y + 5 = 0$

(b) Find the eccentricity, latus rectum and the foci of the ellipse $25x^2 + 45y^2 = 9$
- (a) P and Q are two unlike parallel forces; when P is doubled it is found that the line of action of Q is midway between the lines of action of P and the new resultant. Find P:Q



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- (b) When a cubical die is rolled, find the probability of getting an even integer.
10. (a) Show that the path of a particle moving in space with constant acceleration is a parabola.
- (b) Find the standard deviation of a variety which takes the values 5,10,15,20,25