



Mathematics

- (a) If the universal set is $U = \{ a, b, c, d, e, f, g \}$ and for any subject x , x^c denotes its complement, then for the subject $A = \{ b, c, d \}$, $(A \cap A^c)^c$ is ...

(b) The values of k for which the quadratic equation $kx^2 + 1 = kx + 3x - 11x^2$ has real and equal roots are ...

(c) If $x^2 + 3x - 2 = \frac{8}{x^2 + 3x}$ the $x = \dots$
- (a) The number of parallelograms that can be formed from a set of four parallel lines intersecting another set of three parallel lines is ...

(b) If $x + iy = \sqrt{\frac{a-ib}{c+id}}$ then $(x^2 + y^2)^2 = \dots$

(c) The term independent of x in the expansion of $\left(\sqrt{\frac{x}{3}} + \sqrt{\frac{3}{2x}}\right)^{10}$ is ...
- (a) The radius of the circle passing through the point, $(6, 2)$ two of whose diameters are $x+6 = 6$ and $x+2y = 4$ is ...

(b) The equation of the tangent to the parabola $y^2 = 4x$ which is perpendicular to the line $x - 3y + 6 = 0$ is ...
- (a) Two straight roads intersect at an angle of 60° . A bus on one road is 2 km away from the intersection and a car on the other road is 3 km away from the intersection. Then the direct distance between the two vehicles is ...

(b) An aeroplane flying at a height of 300 metres above the ground passes vertically above another plane at an instant when the angle of elevation of the two planes from the same point on the ground are 60° and 45° respectively. Then the height of the lower plane from the ground is (in metres) ...

(c) If A, B, C, D are the angles of a cyclic quadrilateral the value of $\cos A + \cos B + \cos C + \cos D$ is ...
- (a) $\lim_{x \rightarrow 0} \left\{ \left(3x + \frac{1}{x}\right)^2 - \left(2x - \frac{1}{x}\right)^2 \right\} = \dots$

(b) The derivative of the following function, with respect to x , at $x=1$ is ...

$$y = f(x) = \begin{cases} 2x - 3 & \text{if } x > 1 \\ 2x + 3x & \text{if } x < 1 \end{cases}$$

(c) If $x^y = e^{x-y} y$, then $dy/dx = \dots$
- (a) $\int_{-1/2}^{1/2} \cos x \log \left(\frac{1+x}{1-x}\right) dx = \dots$

(b) $\int \frac{dx}{1+\tan x} = \dots$
- (a) Forces M and N acting at a point O make an angle 150° between them. Their resultant P acts at O has magnitude 2 units and is perpendicular to M . Then in the same unit, the magnitudes of M and N are ...

(b) The values of a, b, c for which the three vectors $\vec{i} + \vec{g} + 2\vec{k}, -\vec{i} + c\vec{k},$



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$2\vec{i} + 2\vec{j} + b\vec{k}$ are pair wise orthogonal are...

(c) The unit vector perpendicular to the two vectors $3\vec{i} + \vec{j} + 2\vec{k}$ and $2\vec{i} + 2\vec{j} + 4\vec{k}$ is ...

8. (a) A horizontal force F is applied to a small object P of mass m on a smooth plane inclined to the horizontal at an angle θ . If F is just enough to keep P in equilibrium , the magnitude of F is ...
- (b) The foot of an uniform ladder is on a rough horizontal ground and the top rests against a smooth vertical wall. The weight of the ladder is 400 units. A man weighting 800 units stands on the ladder one quarter of its length from the bottom. If the inclination of the ladder to the horizontal is 30° , the reaction at the wall is ...
9. (a) A block of mass 2 kg slides down a rough inclined plane; starting from rest at the top. If the inclination of the plane to the horizontal is θ with $\tan \theta = 4/5$, the co-efficient of friction is 3 and the acceleration due to gravity is $g = 9.8$, the velocity of the block when it reaches the bottom is ...
- (b) A boy 1.5 metres tall, standing at a distance of 15 metres from a pillar 6.5 metres high, throws a stone at an angle of 45° to the horizontal. If the acceleration due to gravity is 10, the stone will just touch the top of the pillar if the velocity of projection is ...
10. (a) A final quiz team of 3 students has to be selected from a preliminary team consisting of 6 boys and 4 girls. If the selection is made at random giving same probability for all boys and girls, the probability that the final team will consist of one boy and two girls is ...
- (b) Two fair dice are rolled together once. Each dice has the numbers 1 to 6 written on its different faces. What is the probability that the sum of the numbers appearing on the bottom of the two dice is 7.
- (c) The ages of nine students in a group were found to be 6,13,10,6,16,7,17,12 and 8. What is the median age?