

MHT CET 2021 Mathematics Answer Key PDF

Answer Key

Question 1 Correct Answer – (2) $8\sqrt{3}a^2$

Explanation: The area bounded by the parabola $y^2 = 4ax$ and its latus rectum $x = a$ is evaluated as $\int_0^{2a} 2\sqrt{ax} \, dx = 4a \left[\frac{2}{3} x^{3/2} \right]_0^{2a} = \frac{16\sqrt{3}}{3} a^2$.

Question 2 Correct Answer – (1) 0

Explanation: Expanding the trigonometric terms gives $6 \sin x \cos x = 2 \sin x (2 \cos 2x + 1)$. This equation is satisfied when $\sin x = 0$.

Question 3 Correct Answer – (1) $\vec{a} + \left(\frac{(\vec{p}-\vec{a}) \cdot \vec{b}}{|\vec{b}|^2} \right) \vec{b}$

Explanation: For a point $P(\vec{p})$ and a line $\vec{r} = \vec{a} + \lambda \vec{b}$, the projection of $(\vec{p} - \vec{a})$ on $\vec{b}$ yields $\lambda = \frac{(\vec{p}-\vec{a}) \cdot \vec{b}}{|\vec{b}|^2}$, giving the position vector of the foot of the normal.

Question 4 Correct Answer – (1) $\frac{64}{3}$

Explanation: The area enclosed between the standard parabolas $y^2 = 4ax$ and $x^2 = 4by$ is given by $\frac{16ab}{3}$. Here $a = 2$ and $b = 2$, yielding $\frac{16(2)(2)}{3} = \frac{64}{3}$.

Question 5 Correct Answer – (2) Keratin

Explanation: Keratin is a durable, fibrous structural protein that serves as the key structural component making up human hair, nails, and the outer layer of skin.

Question 6 Correct Answer – (1) $\frac{13}{10}$

Explanation: Splitting the integral at the root $x = 3/5$ gives $\int_0^{3/5} (3-5x)dx + \int_{3/5}^1 (5x-3)dx = \frac{9}{10} + \frac{4}{10} = \frac{13}{10}$.

Question 7 Correct Answer – (2) Perpendicular bisector plane

Explanation: The plane that bisects a line segment AB at a right angle through its midpoint is geometrically defined as the perpendicular bisector plane.

Question 8 Correct Answer – (1) $\frac{10}{3}$

Explanation: The scalar projection of $\vec{a}$ on $\vec{b}$ is given by $\frac{\vec{a} \cdot \vec{b}}{|\vec{b}|}$. Substituting $\vec{a} \cdot \vec{b} = 10$ and $|\vec{b}| = 3$ yields $\frac{10}{3}$.

Question 9 Correct Answer – (1) $a = 2r$

Explanation: In a simple cubic unit cell, the spheres at the corners touch along the cube edge, establishing the simple relationship $a = 2r$.

Question 10 Correct Answer – (1) $e^{e^x} + C$

Explanation: Writing the integral as $\int e^{e^x} \cdot e^x dx$ and substituting $u = e^x \implies du = e^x dx$ simplifies the integration to $\int e^u du = e^u + C$.

Question 11 Correct Answer – (2) 2, 2

Explanation: Raising both sides to the power of 6 to clear the fractional exponents yields $\left(\frac{d^2y}{dx^2}\right)^2 = \left(\frac{dy}{dx}\right)^3$, which clearly has an order of 2 and a degree of 2.

Question 12 Correct Answer – (2) 2, 1

Explanation: Squaring both sides of the differential equation gives $9y'' = y'$. The highest derivative is the second derivative, making the order 2 and its degree 1.

Question 13 Correct Answer – (2) $I_e = I_b + I_c$

Explanation: According to Kirchhoff's current law applied to a transistor, the total current entering the emitter (I_e) is equal to the sum of the base current (I_b) and collector current (I_c).

Question 14 Correct Answer – (3) $64/3$

Explanation: The area enclosed between the two intersecting parabolas is calculated using $\frac{16ab}{3}$. With $a = 2$ and $b = 2$, the area evaluates to $64/3$.

Question 15 Correct Answer – (3) $\pi/\sqrt{7}$

Explanation: Substituting $t = \tan(x/2)$ transforms the integral to $\int_0^\infty \frac{2dt}{t^2+7} = \left[\frac{2}{\sqrt{7}} \tan^{-1} \left(\frac{t}{\sqrt{7}} \right) \right]_0^\infty = \frac{\pi}{\sqrt{7}}$.

Question 16 Correct Answer – (2) Ethylene glycol and Terephthalic acid

Explanation: Terylene (or Dacron) is a polyester copolymer synthesized through the condensation polymerization of ethylene glycol and terephthalic acid.

Question 17 Correct Answer – (1) $k = \frac{[A]_0 - [A]_t}{t}$

Explanation: The integrated rate law for a zero-order reaction is $[A]_t = -kt + [A]_0$, which rearranges directly to give the rate constant expression in option (1).

Question 18 Correct Answer – (3) $1/2$

Explanation: For a fair coin tossed N times, the probability of obtaining an even number of heads is mathematically proven to be exactly $1/2$.

Question 19 Correct Answer – (4) Heat capacity

Explanation: An extensive property depends on the amount of matter in the sample. Heat capacity is extensive, whereas temperature, viscosity, and surface tension are intensive.

Question 20 Correct Answer – (2) Tetrafluoroethene

Explanation: Teflon (PTFE) is a synthetic addition polymer prepared by the free-radical polymerization of the monomer tetrafluoroethene ($CF_2 = CF_2$).

Question 21 Correct Answer – (2) Cu^{2+}

Explanation: In a standard Galvanic cell, the species with the higher standard reduction potential undergoes reduction. Since $E^\circ(Cu^{2+}/Cu) = +0.34 \text{ V} > E^\circ(Ni^{2+}/Ni) = -0.25 \text{ V}$, Cu^{2+} is reduced.