JEE MAIN MOCK TEST
ANSWER KEY

1. (1)
$$E = \frac{-dV}{dr}$$
$$E = \frac{\partial V}{\partial r} = \left[-\frac{\partial V}{\partial x}\hat{i} - \frac{\partial V}{\partial y}\hat{j} - \frac{\partial V}{\partial x}\hat{k} \right]$$
$$= \left[\hat{i}(2xy + z^3) + \hat{j}x^2 + \hat{k}\,3xz^2 \right].$$

2. (1)
$$C_{middle} = 1.5 + 1.5 = 3\mu F$$
Then 3 are in series

3. (4) $P = P_1 + P_2$

4. (1) Balancing length is not affected

5. (1), Resistance required in series is
$$R = \frac{V}{I_g} - G = \frac{nV}{\left[\frac{V}{G}\right]} - G = (n-1)G$$

6. (1)
$$\text{Magnetisation} = \frac{\text{dipole moment}}{\text{volume}}$$
$$= \frac{8 \times 10^{10} \times 9 \times 10^{-24}}{10^{-18}}$$
$$= 7.2 \times 10^5\, Am^{-1}.$$

7. (2)
$$v_L = v_C = 300\,v$$
circuit is under resonance
$$\therefore V_R = V = 220\,V$$
$$Z = R = 100\,\Omega$$
$$I = \frac{V}{Z} = \frac{220\,V}{100\,\Omega} = 2.2\,A$$

8. (4) 9. (4) 10. (3)

11. (3) 12. (2)

13. (1)
log K = 0.3010 K = 2
$$\frac{1}{n} = \tan 45^{\circ}, n = 1$$
$$\frac{x}{m} = Kp^{1/n} = 2 \times (0.6)^1 = 1.2$$

14. (2)
$$\frac{-Ea}{RT} = \frac{-2800K}{T} \qquad Ea = 232.79\,kJmol^{-1}$$

15. (1)

16. (2)
$$\sin^{-1}x - \cos^{-1}x = \frac{\pi}{6} --- (1)$$
$$\sin^{-1}x + \cot^{-1}x = \frac{\pi}{2} --- (2)$$
Solving (1) & (2) $x = \frac{\sqrt{3}}{2}$ is the unique solution.

17. (1)
$$f(x) = \cos^{-1}\left(\frac{x^2-1}{x^2+1}\right) = \cos^{-1}-\left(\frac{1-x^2}{1+x^2}\right) = \pi - \cos^{-1}\left(\frac{1-x^2}{1+x^2}\right)$$
put $x = \tan\theta$. Then $f(x) = \pi - 2\theta = \pi - 2\tan^{-1}x$
$$f'(x) = \frac{-2}{1+x^2}$$

18. (1)

19. (2)

20. (4) If e is the identity element, then
$$a * e = \frac{ae}{2} \Rightarrow a = \frac{ae}{2} \Rightarrow e = 2$$

21. (4)
$R_2 \to R_2 - 2R_1$, $R_3 \to R_3 - 3R_1$ and expand, we get $x^3 = 64$

22. (2) put x = cosx.
$$\text{Then } y = \sin^{-1}\left(\frac{\cos\frac{\theta}{2} + \sin\frac{\theta}{2}}{\sqrt{2}}\right)$$
$$= \sin^{-1}\left[\sin\frac{\pi}{4}.\cos\frac{\theta}{2} + \cos\frac{\pi}{4}.\sin\frac{\theta}{2}\right]$$
$$= \sin^{-1}\sin\left(\frac{\pi}{4} + \frac{\theta}{2}\right) = \frac{\pi}{4} + \frac{1}{2}.\cos^{-1}x$$
$$\frac{dy}{dx} = \frac{-1}{2\sqrt{1-x^2}}$$

23. (4)
Differentiating, we get $(1+x^2)\,y_1 = y$. Again differentiating

24. (4) $y^2 = 2ax$ ...(1)
Put $x = a/2$, $y^2 = 2a\,a/2$, $y = \pm a$,
$\therefore$ The points are $(a/2, a)$ and $(a/2, -a)$
on differentiation of (1) w.r.t x we get
$$2y\frac{dy}{dx} = 2a \Rightarrow \frac{dy}{dx} = \frac{a}{y}$$
$$\text{At } (a/2, a)\ \frac{dy}{dx} = \frac{a}{y} = \frac{a}{a} = 1 = m_1$$
$$\text{At } (a/2, -a)\ \frac{dy}{dx} = \frac{a}{y} = \frac{a}{-a} = -1 = m_2$$
Since $m_1 \times m_2 = -1$, the two tangents are at right angles.

25. (1)
$$f'(x) = 2/3\,(x-1)^{-1/3} \text{ which does not exist}$$
for $x = 1$. $\because$ f(x) is not derivable in any interval containing 1. $\therefore$ f '(x) exists is (1,2)
$\therefore$ Mean value theorem is applicable in (1,2)