1. Find the following integrals.

1. $\int 3x^7 dx$ 2. $\int 4\sqrt{x}\, dx$ 3. $\int \frac{dx}{\sqrt{x}}$ 4. $\int (x^3 - 5x^2 + 7x - 11)dx$

5. $\int \left(\sqrt[3]{x} - \frac{1}{\sqrt[3]{x}}\right)dx$ 6. $\int 3x dx$ 7. $\int 5x^2 dx$ 8. $\int \frac{1}{2}x^3 dx$

9. $\int 0.4x^4 dx$ 10. $\int 12x^3 dx$ 11. $\int 15t^2 dt$ 12. $\int \frac{d\theta}{\theta}$

13. $\int (4x^2 - 5x + 1)dx$ 14. $\int (3x^4 - 5x^3)dx$ 15. $\int x(8x - \frac{1}{2})dx$ 16. $\int 6x^2(x^2 + x)dx$

2. A particle moves on x-axis as per equation $x = (t^3 - 9t^2 + 15t + 2)$m. Distance travelled by the particle between t = 0 and t = 5 s is

(A) 25 m (B) 39 m (C) 23 m (D) 52 m

3. Suppose velocity of a cricket ball hit by a batsman is given by

$\vec{v} = \left(2\hat{i} + 6\hat{j} + (20 - 10t)\hat{k}\right)$m/s

Find the time(t) when acceleration of the ball is perpendicular to its velocity.

(A) 1s (B) 2s (C) 3s (D) 4s

4. A particle moves along a straight line and its position as a function of time is given by $x = t^3 - 3t^2 + 3t + 3$, then particle

(A) stops at t=1s and reverses its direction of motion

(B) stops at t=1 s and continues further without change of direction

(C) stops at t= 2 s and reverses its direction of motion

(D) stops at t= 2s and continues further without change of direction.

5. A ball is thrown vertically upwards with some speed. It reaches two points A and B one after another such that heights of A and B are one fourth and three-fourth of the maximum height attained. If the total time of flight is T, the maximum time taken by the ball to travel from A to B, is :-

(A) $\left(\frac{\sqrt{3}+1}{4}\right)T$ (B) $\left(\frac{\sqrt{3}-1}{2}\right)T$ (C) $\left(\frac{\sqrt{3}+1}{2}\right)T$ (D) $\frac{T}{\sqrt{2}}$

6. The initial velocity of a particle is u and the acceleration is given by (kt), where k is a positive constant. The distance travelled in time t is :

(A) $s = ut^2 + kt^2$ (B) $s = ut + (kt^3/6)$ (C) $s = ut + (kt^3/2)$ (D) $s = (ut^2/2) + (kt^3/6)$

7. A motor boat of mass m moves along a lake with velocity V_0. At t = 0, the engine of the boat is shut down. Magnitude of resistance force offered to the boat is equal to rV. (V is instantaneous speed). What is the total distance covererd till it stops completely? [Hint : $F(x) = mV\frac{dV}{dx} = -rV$]

(A) mV_0/r (B) $3mV_0/2r$ (C) $mV_0/2r$ (D) $2mV_0/r$

8. A particle moving in a straight line has its velocity varying with time according to relation $v = t^2 - 6t + 8$ (m/s) where t is in seconds. The **CORRECT** statement(s) about motion of this particle is/are :-

(A) Velocity changes its direction two times within first 3 sec.

(B) Displacement in first 2 seconds is equal to distance travelled.

(C) The farthest distance of particle from origin on negative x axis is at t = 3 sec.

(D) Acceleration is increasing in the interval t = 3 sec to t = 5 sec.

Paragraph for Question nos. 9 to 11

The XIth class students of ALLEN designed a rocket. The rocket was launched from cycle stand of ALLEN straight up into the air. At t = 0, the rocket is at y = 0 with $V_y(t = 0) = 0$. The velocity of the rocket is given by : $V_y = (24t - 3t^2)$ m/s for $0 \le t \le t_b$ where t_b is the time at which fuel burns out. Vertically upward direction is taken as positive. ($g = 10\ m/s^2$)

9. The expression for the acceleration $a_y(t)$ valid at all times in the interval $0 < t < t_b$ is

(A) $12t^2 - t^3$ (B) $24 - 6t$ (C) $24t - 6t^2$ (D) $24 - 6t - g$

10. The displacement of the rocket till the fuel burns out ($t = t_b$) is

(A) 128 m (B) 486 m (C) 203 m (D) 242 m

11. The time taken for rocket to reach its maximum height is

(A) 4 sec. (B) 8 sec. (C) 8.8 sec (D) 9.6 sec.

N_Race # 17 **ANSWER KEY**

1. **Ans.** 1. $\frac{3}{8}x^8+C$ 2. $\frac{8}{3}x^{3/2}+C$ 3. $2\sqrt{x}+C$ 4. $\frac{x^4}{4}-\frac{5}{3}x^3+\frac{7}{2}x^2-11x+C$

5. $\frac{3}{4}x^{4/3}-\frac{3}{2}x^{2/3}+C$ 6. $\frac{3x^2}{2}+C$ 7. $\frac{5x^3}{3}+C$ 8. $\frac{x^4}{8}+C$

9. $\frac{0.4x^5}{5}+C$ 10. $3x^4+C$ 11. $5t^3+C$ 12. $\ell n\theta+C$

13. $\frac{4x^3}{3}-\frac{5x^2}{2}+x+C$ 14. $\frac{3x^5}{5}-\frac{5x^4}{4}+C$ 15. $\frac{8x^3}{3}-\frac{x^3}{4}+C$ 16. $\frac{6x^5}{5}+\frac{6x^4}{4}+C$

2. Ans. (B) **3. Ans. (B)** **4. Ans. (B)** **5. Ans. (A)**

6. Ans. (B) **7. Ans. (A)** **8. Ans. (B, D)** **9. Ans. (B)**

10. Ans. (C) **11. Ans. (D)**