**Q1. 22 January Shift 1**

If $\int(\sin x)^{\frac{-11}{2}}(\cos x)^{\frac{-5}{2}}dx = -\frac{p_1}{q_1}(\cot x)^{\frac{9}{2}} - \frac{p_2}{q_2}(\cot x)^{\frac{5}{2}} - \frac{p_3}{q_3}(\cot x)^{\frac{1}{2}} + \frac{p_4}{q_4}(\cot x)^{\frac{-3}{2}} + \mathrm{C}$, where $p_i$ and $q_i$ are positive integers with $\gcd(p_i, q_i) = 1$ for $i = 1, 2, 3, 4$ and C is the constant of integration, then $\frac{15p_1p_2p_3p_4}{q_1q_2q_3q_4}$ is equal to

**Q2. 23 January Shift 1**

Let $f(x) = \int \frac{(2-x^2)\cdot e^x}{(\sqrt{1+x})(1-x)^{3/2}}\,\mathrm{d}x$. If $f(0) = 0$, then $f\left(\frac{1}{2}\right)$ is equal to:

(1) $\sqrt{3\mathrm{e}} - 1$ (2) $\sqrt{3\mathrm{e}} + 1$ (3) $\sqrt{2\mathrm{e}} + 1$ (4) $\sqrt{2\mathrm{e}} - 1$

**Q3. 23 January Shift 2**

Let $\mathrm{I}(x) = \int \frac{3dx}{(4x+6)\left(\sqrt{4x^2+8x+3}\right)}$ and $\mathrm{I}(0) = \frac{\sqrt{3}}{4} + 20$. If $\mathrm{I}\left(\frac{1}{2}\right) = \frac{a\sqrt{2}}{b} + \mathrm{c}$, where $a, b, \mathrm{c} \in \mathrm{N}, \gcd(a, b) = 1$, then $a + b + c$ is equal to

(1) 30 (2) 31 (3) 29 (4) 28

**Q4. 24 January Shift 1**

Let $f(t) = \int \left(\frac{1-\sin(\log_e t)}{1-\cos(\log_e t)}\right)dt, t > 1$.

If $f\left(e^{\pi/2}\right) = -e^{\pi/2}$ and $f\left(e^{\pi/4}\right) = \alpha e^{\pi/4}$, then $\alpha$ equals

(1) $1 + \sqrt{2}$ (2) $-1 - \sqrt{2}$ (3) $-1 - 2\sqrt{2}$ (4) $-1 + \sqrt{2}$

**Q5. 28 January Shift 2**

Let $f(x) = \int \frac{\mathrm{d}x}{x^{\left(\frac{2}{3}\right)} + 2x^{\left(\frac{1}{2}\right)}}$ be such that $f(0) = -26 + 24\log_e(2)$. If $f(1) = \mathrm{a} + \mathrm{b}\log_e(3)$, where $\mathrm{a}, \mathrm{b} \in \mathbf{Z}$, then $\mathrm{a} + \mathrm{b}$ is equal to :

(1) -26 (2) -11 (3) -5 (4) -18

## ANSWER KEYS

**1.** 16 **2.** (1) **3.** (2) **4.** (2) **5.** (2)