Q1. Let $a_1, a_2, a_3, \ldots$ be a G.P. of increasing positive terms. If $a_1 a_5 = 28$ and $a_2 + a_4 = 29$, then a_6 is equal to:

(1) 628
(2) 812
(3) 526
(4) 784

Q2. Let $x = x(y)$ be the solution of the differential equation $y^2\, \mathrm{d}x + \left(x - \frac{1}{y}\right)\mathrm{d}y = 0$. If $x(1) = 1$, then $x\left(\frac{1}{2}\right)$ is :

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

Q3. Two balls are selected at random one by one without replacement from a bag containing 4 white and 6 black balls. If the probability that the first selected ball is black, given that the second selected ball is also black, is $\frac{m}{n}$, where $\gcd(m, n) = 1$, then $m + n$ is equal to :

(1) 4
(2) 14
(3) 13
(4) 11

Q4. The product of all solutions of the equation $\mathrm{e}^{5(\log_e x)^2 + 3} = x^8, x > 0$, is :

(1) $e^{8/5}$
(2) $e^{6/5}$
(3) e^2
(4) e

Q5. Let the triangle PQR be the image of the triangle with vertices $(1, 3), (3, 1)$ and $(2, 4)$ in the line $x + 2y = 2$. If the centroid of $\triangle$PQR is the point (α, β), then $15(\alpha - \beta)$ is equal to :

(1) 19
(2) 24
(3) 21
(4) 22

Q6. Let for $f(x) = 7\tan^8 x + 7\tan^6 x - 3\tan^4 x - 3\tan^2 x$, $\quad \mathrm{I}_1 = \int_0^{\pi/4} f(x)\mathrm{d}x$ and $\mathrm{I}_2 = \int_0^{\pi/4} x f(x)\mathrm{d}x$. Then $7\mathrm{I}_1 + 12\mathrm{I}_2$ is equal to :

(1) 2
(2) 1
(3) 2π
(4) π

Q7. Let the parabola $y = x^2 + \mathrm{p}x - 3$, meet the coordinate axes at the points P, Q and R . If the circle C with centre at $(-1, -1)$ passes through the points P, Q and R, then the area of $\triangle PQR$ is :

(1) 7
(2) 4
(3) 6
(4) 5

Q8. Let $\mathrm{L}_1 : \frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$ and $\mathrm{L}_2 : \frac{x-2}{3} = \frac{y-4}{4} = \frac{z-5}{5}$ be two lines. Then which of the following points lies on the line of the shortest distance between L_1 and L_2 ?

(1) $\left(\frac{14}{3}, -3, \frac{22}{3}\right)$
(2) $\left(-\frac{5}{3}, -7, 1\right)$
(3) $\left(2, 3, \frac{1}{3}\right)$
(4) $\left(\frac{8}{3}, -1, \frac{1}{3}\right)$

Q9. Let $f(x)$ be a real differentiable function such that $f(0) = 1$ and $f(x + y) = f(x)f'(y) + f'(x)f(y)$ for all $x, y \in \mathbf{R}$. Then $\sum_{\mathrm{n}=1}^{100} \log_e f(\mathrm{n})$ is equal to :

(1) 2525
(2) 5220
(3) 2384
(4) 2406

Q10. From all the English alphabets, five letters are chosen and are arranged in alphabetical order. The total number of ways, in which the middle letter is ' M ', is :