Name _____

1. Calculate the average value of the function $g(x,y) = 12xyz^2$ over the box defined by $\{(x,y,z) \,|\, 1 \le x \le 3,\, 0 \le y \le 1,\, -1 \le z \le 2\}$.

(A) 0   (B) 2   (C) 3

(D) 4   (E) 12   (F) 13

2. Water is being poured into a container shaped like the paraboloid $z = x^2 + y^2$ at a constant rate (where x, y and z are all measured in meters). How much longer will it take to fill the container to a height of 3 meters than to fill it to a height of 1 meter?

(A) $\sqrt{3}$ times as long   (B) 3 times as long   (C) $3\sqrt{3}$ times as long

(D) 9 times as long   (E) $9\sqrt{3}$ times as long   (F) 27 times as long

3. Calculate the work done by the force field $F = \langle 5y, 7x^2 \rangle$ on a particle that moves along the curve given by $x = t^2$, $y = 2t^3$ for $0 \le t \le 1$.

(A) 4   (B) 5   (C) 10

(D) 15   (E) 16   (F) 32

4. Calculate $\iiint_S \dfrac{1}{\sqrt{x^2 + y^2 + z^2}}\, dV$ where S is the spherical shell bounded by the two spheres $x^2 + y^2 + z^2 = 1$ and $x^2 + y^2 + z^2 = 9$.

(A) 8π (B) 12π (C) 16π

(D) 24π (E) 30π (F) 36π

5. Calculate $\int_C (1 + \sin \pi y)\, dx + (2 + \pi x \cos \pi y)\, dy$ where the curve C follows the ellipse

$4x^2 + y^2 = 1$ from the point $(0, -1)$ to the point $(0, 1)$.

(A) 0   (B) 1   (C) 2

(D) 4   (E) 6   (F) 8

6. Calculate $\int_C (y + e^{-2x})\, dx + (2x - \cos^2 y)\, dy$ where C is the circle of radius 2 centered

at the point $(1, 3)$, traversed counterclockwise .

(A) 2π (B) 4π (C) 8π

(D) $2\pi e$ (E) $4\pi e$ (F) 0

7. Calculate $\iint_R 4x^2 \, dA$ where R is the region in the first quadrant bounded by the

graphs of $y = 1/x$, $y = 4/x$, $x = y$ and $x = 9y$ (so R is a region with four corners, at $(1,1)$, $(2,2)$, $(6, 2/3)$ and $(3, 1/3)$. Letting $u = xy$ and $v = x/y$ might help. Don't forget...).

(A) 60   (B) 120   (C) 180

(D) 225   (E) 240   (F) 1200

8. Let H be the top half of the ball $x^2 + y^2 + z^2 \le 4$ (i.e., the part where $z \ge 0$). Calculate $\iiint_H x^2 \, dV$

(A) $\dfrac{16\pi}{15}$ (B) $\dfrac{64\pi}{15}$ (C) $\dfrac{81\pi}{5}$

(D) $\dfrac{81\pi}{15}$ (E) $\dfrac{1250\pi}{3}$ (F) $\dfrac{1250\pi}{15}$