Problem 1 (4 points)

This practice exam is provided as a way for students to practice solving the exam under a time limit. We suggest that you set a timer for 60 minutes, put away your notes and calculator, and solve the exam in one sitting.

On the real exam, you will earn 4 points for correctly filling out the scantron. The real exam is multiple choice graded all-or-nothing. (In this practice exam, ignore any prompts to show your work. While showing your work is good practice, on the exam it will not be graded.)

Answer = ______________________________

Problem 2 (8 points)

The extreme values of $f(x,y,z) = 3x + 2y + 6z$ with constraint $x^2 + y^2 + z^2 = 4$ are.

To receive the full 5 points, you must show all your work on this problem.

A. The maximum of f is 7 and the minimum of f is -7
B. The maximum of f is 28 and the minimum of f is -28
C. The maximum of f is 14 and the minimum of f is -7
D. The maximum of f is 7 and the minimum of f is -14
E. The maximum of f is 14 and the minimum of f is -14

Problem 3 (8 points)

Compute the double integral $\iint_R \cos(x+y)\,dA$, where R is the rectangle $[0,\pi] \times [0,\pi]$.

A. -2
B. -4
C. 2
D. 0
E. 4

Problem 4 (8 points)

Reverse the order of integration and evaluate the double integral: $\int_0^1 \int_{x^2}^1 6\sqrt{y}\cos\left(y^2\right)\,dy\,dx$

A. $\sin(1)$
B. $3\cos(1)$
C. $2\cos(1) - 2$
D. $3\sin(1)$
E. $2\sin(1)$

Problem 5 (8 points)

Let D be the region in the **first quadrant** between the circles $x^2 + y^2 = 1$ and $x^2 + y^2 = 4$. Evaluate the integral $\displaystyle\iint\limits_D \frac{x^2 y}{(x^2+y^2)^{3/2}}\, dA$.

A. 14/3
B. 1/2
C. 10/3
D. 5/6
E. 3/2

Problem 6 (8 points)

Compute the triple integral

$$\iint\int_E 3y dV \text{ ,}$$

where E is a region under the plane $x + y + z = 2$ in the first octant.

A. 1
B. 3
C. 6
D. 4
E. 2

Problem 7 (8 points)

The integral

$$\int_0^{\sqrt{2}} \int_{-\sqrt{2-x^2}}^{\sqrt{2-x^2}} \int_{\sqrt{3x^2+3y^2}}^{\sqrt{8-x^2-y^2}} xy^2 z dz dy dx$$

when converted to cylindrical coordinates becomes

A. $\displaystyle\int_{\frac{-\pi}{2}}^{\frac{\pi}{2}} \int_0^{\sqrt{2}} \int_{\sqrt{3}r}^{\sqrt{8-r^2}} r^4 z \cos\theta \sin^2\theta dz dr d\theta$

B. $\displaystyle\int_{\frac{-\pi}{2}}^{\frac{\pi}{2}} \int_0^{\sqrt{2}} \int_{\sqrt{3}r}^{\sqrt{8-r^2}} r^3 z \cos\theta \sin^2\theta dz dr d\theta$

C. $\displaystyle\int_{\frac{-\pi}{2}}^{\frac{\pi}{2}} \int_0^{2} \int_{\sqrt{3}r}^{\sqrt{8-r^2}} r^4 z \cos\theta \sin^2\theta dz dr d\theta$

D. $\displaystyle\int_0^{\pi} \int_0^{\sqrt{2}} \int_{\sqrt{3}r}^{\sqrt{8-r^2}} r^4 z \cos\theta \sin^2\theta dz dr d\theta$

E. $\displaystyle\int_{\frac{-\pi}{2}}^{\frac{\pi}{2}} \int_0^{2} \int_{\sqrt{3}r}^{\sqrt{8-r^2}} r^4 z \cos\theta \sin^2\theta dz dr d\theta$

Problem 8 (8 points)

Compute $\iint\int_E z dV$, where E is bounded by the sphere $x^2+y^2+z^2=1$ and the coordinate planes in the first octant.

A. $\frac{3\pi}{8}$
B. $\frac{\pi}{16}$
C. $\frac{\pi}{8}$
D. $\frac{\pi}{12}$
E. $\frac{\pi}{6}$

Problem 9 (8 points)

A lamina with density $\rho(x,y)= xy$ occupies the region of the plane bounded by $y=x^2$, $y=1$ and $x=0$. The mass of lamina is equal to $\frac{1}{6}$. Find the y-coordinate of its center of mass.

A. 2/3
B. 3/4
C. 5/6
D. 12/21
E. 7/8

Problem 10 (8 points)

Let $f(x,y,z)=x^2+y^3+z^4$ and $g(x,y,z)=3x+4y+\frac{z^2}{2}$. If $\vec{\nabla}f(2,1,-1)$ is perpendicular to $\vec{\nabla}g(a,b,c)$, then

A. $c=10$
B. $c=6$
C. $c=2$
D. $c=8$
E. $c=4$

Problem 11 (8 points)

Compute the line integral $\int_C (4x^3 + y^3)\,ds$, where C is the line segment from (0,0) to (1,2).

A. 0
B. $3\sqrt{5}$
C. $\sqrt{5}\pi$
D. -5
E. $\frac{5\sqrt{5}}{4}$

Problem 12 (8 points)

Evaluate the line integral $\int_C xydx - y^2dy$, where C is the line segment from (0,0) to (2,6).

A. 42
B. 36
C. -64
D. -44
E. -36

Problem 13 (8 points)

Compute the line integral $\int_C F \cdot dr$, where $F = \langle yz, xz, xy \rangle$ and the curve C is parametrized by $r(t) = \langle t^2, t, t^3 - 3t \rangle$, $1 \leq t \leq 2$.

A. 18
B. 10
C. -16
D. 0
E. 8π

Answer Key

PROBLEM	ANSWER
1.	$Name$
2.	**E.** The maximum of f is 14 and the minimum of f is -14
3.	**B.** -4
4.	**D.** $3\sin(1)$
5.	**B.** 1/2
6.	**E.** 2
7.	**A.** $\int_{\frac{-\pi}{2}}^{\frac{\pi}{2}}\int_0^{\sqrt{2}}\int_{\sqrt{3}r}^{\sqrt{8-r^2}} r^4 z\cos\theta\sin^2\theta dz dr d\theta$
8.	**B.** $\frac{\pi}{16}$
9.	**B.** 3/4
10.	**B.** $c=6$
11.	**B.** $3\sqrt{5}$
12.	**C.** -64

PROBLEM	ANSWER
13.	**A.** 18