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)

Find the minimum value of $f(x,y) = 2x + 3y + 2$ given that $2x^2 + 5xy + 4y^2 = 28$

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

A. -3
B. -8
C. -2
D. -1
E. -6

Problem 3 (8 points)

Evaluate $\iint\limits_R \frac{x^2 y}{2+x^3}\, dA$ over the region $R = \{(x,y)\colon 1 \le x \le 2, 0 \le y \le 4\}$.

A. $\frac{8}{3}(\ln(10) - \ln(3))$
B. $\frac{8}{3}(\ln(5) - \ln(1.5))$
C. $\ln(33)$
D. $\frac{8}{3}(\arctan(5) - \arctan(1.5))$
E. $8\left(\frac{7}{3} + \ln(2)\right)$

Problem 4 (8 points)

By changing the order of integration, compute $\int_0^1 \int_0^{\sqrt{1-x^2}} \sqrt{1-y^2}\, dy\, dx$

A. $2/3$

B. $\pi/4$

C. 1

D. $1/3$

E. 0

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 $\iint\limits_D \frac{x^2 y}{(x^2+y^2)^{3/2}}\, dA$.

A. 14/3

B. 5/6

C. 10/3

D. 1/2

E. 3/2

Problem 6 (8 points)

Consider the tetrahedron E with vertices (0,0,0), (1,0,0), (0,2,0), (0,0,3). Express $\iint\int_E xdV$ as an iterated integral in the order $dzdydx$.

A. $\int_0^1 \int_0^{2-2x} \int_0^{-3x-\frac{3}{2}y+3} xdzdydz$

B. $\int_0^1 \int_0^{2-2x} \int_0^{-3x+\frac{3}{2}y+3} xdzdydz$

C. $\int_0^1 \int_0^{2-2x} \int_0^{3x-\frac{3}{2}y-3} xdzdydz$

D. $\int_0^1 \int_0^{2-2x} \int_0^{3x+\frac{3}{2}y-3} xdzdydz$

E. $\int_0^1 \int_0^{2-2x} \int_0^{-3x-\frac{3}{2}y-3} xdzdydz$

Problem 7 (8 points)

The triple integral

$$\int_{-3}^{3}\int_{0}^{\sqrt{9-x^2}}\int_{0}^{\sqrt{x^2+y^2}} 8\left(x^2+y^2\right)dzdydx$$

when converted to cylindrical coordinates becomes

A. $\int_0^{\pi}\int_0^{9}\int_0^{r} 8r^2 dzdrd\theta$

B. $\int_0^{\pi}\int_0^{3}\int_0^{r} 8r^3 zdzdrd\theta$

C. $\int_0^{\pi}\int_0^{9}\int_0^{r} 8r^2 dzdrd\theta$

D. $\int_0^{\pi}\int_0^{3}\int_0^{r} 8r^2 zdzdrd\theta$

E. $\int_0^{\pi}\int_0^{3}\int_0^{r} 8r^3 dzdrd\theta$

Problem 8 (8 points)

Convert the integral to spherical coordinates and compute it:

$$\int_{-2}^{2}\int_{0}^{\sqrt{4-x^2}}\int_{\sqrt{x^2+y^2}}^{\sqrt{8-x^2-y^2}} 3dzdy\,dx$$

A. $10\left(\sqrt{2}-1\right)\pi$

B. $12\left(\sqrt{2}-1\right)\pi$

C. $16\left(\sqrt{2}-1\right)\pi$

D. $8\left(\sqrt{2}-1\right)\pi$

E. $2\left(\sqrt{2}-1\right)\pi$

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. 3/4

B. 5/6

C. 7/8

D. 12/21

E. 2/3

Problem 10 (8 points)

Let $f(x,y,z) = x^2 + xy + z^4 - z$ and let (a,b,c) be a point where $\nabla f(a,b,c) =< 3,5,-5 >$. Find the value of $a + b - c$.

A. 0
B. -3
C. -2
D. 1
E. -1

Problem 11 (8 points)

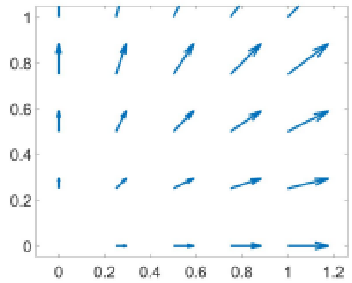
Compute the line integral $\int_C (4x^3 + y^3)\, ds$, where C is the line segment from (0,0) to (1,2).

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

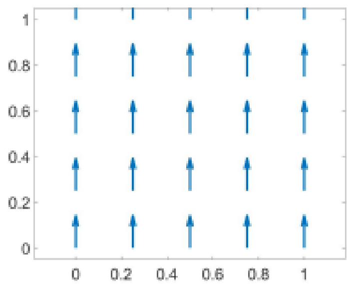
Problem 12 (8 points)

A particle is traveling on the path $y = x$ from (0,0) to (1,1). For which of the following force vector fields is the work done equal to 0?

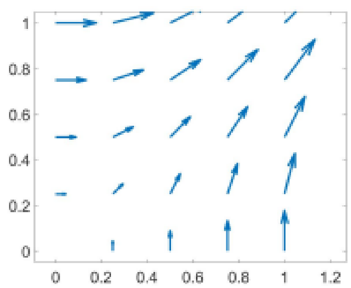
A.



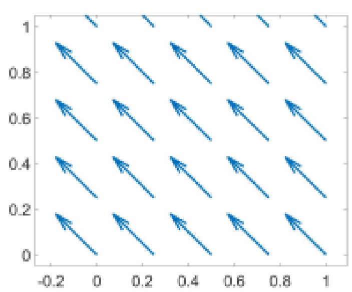
B.



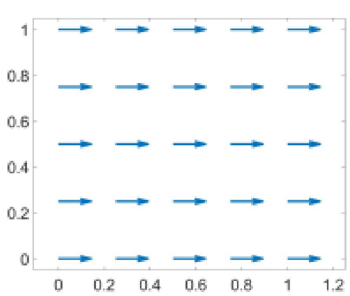
C.



D.



E.



CORRECTION:

$x^2 - 3y^2$

Problem 13 (8 points)

If $\vec{F} = (3 + 2xy)\vec{i} + (x^2 - 3y)\vec{j}$ and $\vec{F} = \nabla\vec{f}$, find $\int_C \vec{\nabla} f \cdot d\vec{r}$ if the curve C is parametrized as $\vec{r}(t) = e^t \sin(t)\vec{i} + e^t \cos(t)\vec{j}$, $0 \le t \le \pi$.

A. $e^{3\pi} + 1$

B. π^3

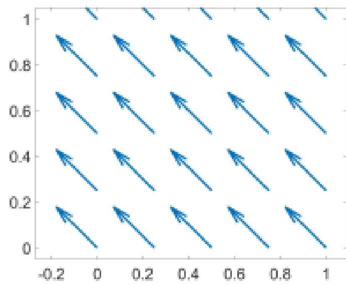
C. 0

D. $-e^{3\pi} - 1$

E. $-\pi^3$

Answer Key

PROBLEM	ANSWER
1.	$Name$
2.	**E.** -6
3.	**A.** $\frac{8}{3}(\ln(10) - \ln(3))$
4.	**A.** $2/3$
5.	**D.** 1/2
6.	**A.** $\int_0^1 \int_0^{2-2x} \int_0^{-3x-\frac{3}{2}y+3} xdzdydz$
7.	**E.** $\int_0^\pi \int_0^3 \int_0^r 8r^3 dzdrd\theta$
8.	**C.** $16\left(\sqrt{2}-1\right)\pi$
9.	**A.** 3/4
10.	**E.** -1
11.	**E.** $3\sqrt{5}$

PROBLEM	ANSWER
12.	D. 
13.	A. $e^{3\pi}+1$