Math 2204 Common Final Exam Fall 2017

Test Version: A

INSTRUCTIONS: Please enter your **NAME**, **ID Number**, **Test Version**, and your **CRN** on the opscan sheet. The CRN should be written in the field labeled **Class ID** and the test version (A, B, or C) under **Test ID**. Leave the Date, Instructor/Class, Test Name, and Time fields blank. Darken the appropriate circles below your ID number, below Class ID, and beside Test Version. **Use a number 2 pencil**. Machine grading may ignore faintly marked circles.

Mark your answers to the test questions in rows 1-14 of the opscan sheet. Your score on this test will be the number of correct answers. You have one hour to complete this portion of the exam. Turn in the opscan sheet with your answers and the question sheets at the end of this part of the final exam.

Exam Policies: You may not use a book, notes, formula sheet, calculator or a computer. Giving or receiving unauthorized aid is an Honor Code Violation.

Signature: ______________________________

Name (printed): ______________________________

Student ID #: ______________________________

[1] Which of the following integrals represents the volume of the solid that lies between $z = x^2 + (y-1)^2$ and $z = 2 - 2y$?

A) $\displaystyle\int_0^{2\pi}\int_0^1 (r - r^3)\,\mathrm{d}r\,\mathrm{d}\theta$ B) $\displaystyle\int_0^{2\pi}\int_0^1 2(r - r^2\sin\theta)\,\mathrm{d}r\,\mathrm{d}\theta$

C) $\displaystyle\int_0^{\pi}\int_0^{2\sin\theta} (r - r^3)\,\mathrm{d}r\,\mathrm{d}\theta$ D) $\displaystyle\int_0^{\pi}\int_0^{2\sin\theta} 2(r - r^2\sin\theta)\,\mathrm{d}r\,\mathrm{d}\theta$

[2] Suppose that for a vector function $\boldsymbol{r}(t)$ we know that $\boldsymbol{r'}(1) = \langle 2, 2, -1\rangle$ and the principal unit normal vector is $\boldsymbol{N}(1) = \dfrac{1}{3}\langle -1, 2, 2\rangle$. What is $\boldsymbol{B}(1)$, the binormal vector when $t = 1$?

A) $\dfrac{1}{3}\langle -2, 1, -2\rangle$ B) $\dfrac{1}{3}\langle 2, 1, 2\rangle$ C) $\dfrac{1}{3}\langle 2, -1, 2\rangle$ D) $\dfrac{1}{3}\langle -2, -1, -2\rangle$

[3]

(x,y)	$f(x,y)$	$f_x(x,y)$	$f_y(x,y)$	$f_{xx}(x,y)$	$f_{yy}(x,y)$	$f_{xy}(x,y)$
$(0,0)$	1	0	0	3	2	1
$(0,1)$	2	5	0	-2	-3	1
$(1,0)$	0	1	4	2	4	0
$(1,1)$	-4	0	0	1	2	-2

Let $f(x,y)$ be a function with continuous second partial derivatives. The table above shows

A) no local maximum and one local minimum of f.

B) one local maximum and no local minimum of f.

C) one local maximum and two local minima of f.

D) two local maxima and one local minimum of f.

[4] Which of the following integrals computes the volume of the solid region that lies below $z = \sqrt{x^2 + y^2}$ and inside $x^2 + y^2 + z^2 = 4$?

A) $\displaystyle\int_0^{2\pi}\int_0^{\pi/4}\int_0^2 \rho^2 \sin\phi \; d\rho \; d\phi \; d\theta$

B) $\displaystyle\int_0^{2\pi}\int_{\pi/4}^{\pi/2}\int_0^2 \rho^2 \sin\phi \; d\rho \; d\phi \; d\theta$

C) $\displaystyle\int_0^{2\pi}\int_{\pi/4}^{3\pi/4}\int_0^2 \rho^2 \sin\phi \; d\rho \; d\phi \; d\theta$

D) $\displaystyle\int_0^{2\pi}\int_{\pi/4}^{\pi}\int_0^2 \rho^2 \sin\phi \; d\rho \; d\phi \; d\theta$

[5] Consider a circular cylinder whose radius r is **increasing** at the rate of 2 cm / min and whose height h is **decreasing** at the rate of 1 cm / min. When the radius is 4 cm and height is 3 cm, at what rate is its volume $V = \pi r^2 h$ increasing?

A) 24π cm^3 / min B) 32π cm^3 / min C) 40π cm^3 / min D) 64π cm^3 / min

[6] The level curves of $f(x,y) = e^{x^2+2y-4}$ are

A) Ellipses B) Hyperbolas C) Exponential curves D) Parabolas

[7] Let $f(x,y) = \dfrac{xy}{x^2+y^4}$. Which of the following statements is **true**?

A) $\displaystyle\lim_{(x,y)\to(0,0)} f(x,y)$ does not exist because the limit along $x=0$ does not exist.

B) $\displaystyle\lim_{(x,y)\to(0,0)} f(x,y)$ does not exist because limits along $x=0$ and $y=x$ exist but do not agree.

C) $\displaystyle\lim_{(x,y)\to(0,0)} f(x,y)$ does not exist because limits along $x=0$ and $y=x^2$ exist but do not agree.

D) $\displaystyle\lim_{(x,y)\to(0,0)} f(x,y) = 0$.

[8] Compute $\displaystyle\int_0^1 \int_y^1 y\sqrt{1-x^3}\, \mathrm{d}x\, \mathrm{d}y$.

A) $\dfrac{4}{15}$ B) $\dfrac{8}{15}$ C) $\dfrac{1}{3}$ D) $\dfrac{1}{9}$

[9] A line $\mathcal{L}$ through the point $(1,0,2)$ is parallel to the line with vector equation

$\boldsymbol{r}(t) = \langle 2,\ 4,\ 1\rangle + t\langle 2,\ 3,\ -2\rangle$.

Find the x-coordinate of the point where the line $\mathcal{L}$ intersects the plane $x-3y-z=9$.

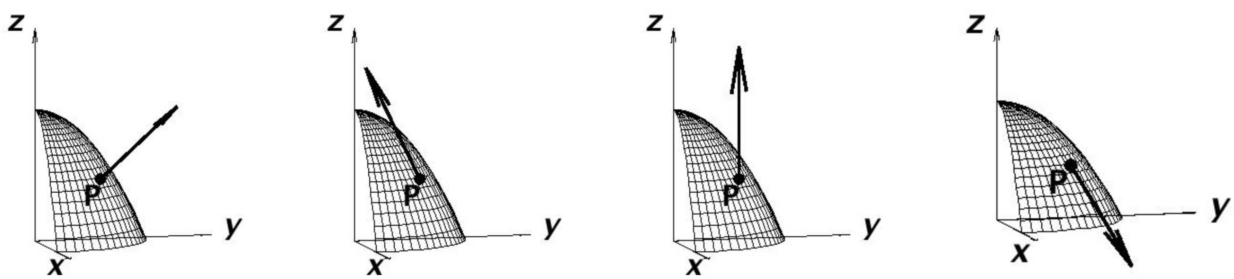
A) -3 B) -4 C) -5 D) -6

[10] Rewrite $\displaystyle\int_0^{16} \int_0^{\sqrt{x}} \int_0^{16-x} \mathrm{d}z\, \mathrm{d}y\, \mathrm{d}x$ in the order $\mathrm{d}x\, \mathrm{d}z\, \mathrm{d}y$.

A) $\displaystyle\int_0^4 \int_0^{16-y^2} \int_{y^2}^{16-z} \mathrm{d}x\, \mathrm{d}z\, \mathrm{d}y$ B) $\displaystyle\int_0^4 \int_0^{16-y} \int_{y^2}^{16-z} \mathrm{d}x\, \mathrm{d}z\, \mathrm{d}y$

C) $\displaystyle\int_0^4 \int_0^{\sqrt{16-y}} \int_{y^2}^{16-z} \mathrm{d}x\, \mathrm{d}z\, \mathrm{d}y$ D) $\displaystyle\int_0^4 \int_0^{16} \int_{y^2}^{16-z} \mathrm{d}x\, \mathrm{d}z\, \mathrm{d}y$

[11] Each of the figures below shows the level surface $F(x, y, z) = 0$ and a vector. One of the vectors points in the direction in which F increases fastest at point P. This should be



A) B) C) D)

[12] Consider the line $\mathcal{L}$ in $\mathbb{R}^3$ through the points A and B. Suppose P is a point not on $\mathcal{L}$, and Q is the point on $\mathcal{L}$ that is closest to P. Which of the following gives $|\overrightarrow{AQ}|$?

A) $\dfrac{|\overrightarrow{AP} \cdot \overrightarrow{AB}|}{|\overrightarrow{AB}|^2}$ B) $\dfrac{|\overrightarrow{AP} \cdot \overrightarrow{AB}|}{|\overrightarrow{AB}|}$ C) $\dfrac{|\overrightarrow{AP} \cdot \overrightarrow{AB}|}{|\overrightarrow{AP}|^2}$ D) $\dfrac{|\overrightarrow{AP} \cdot \overrightarrow{AB}|}{|\overrightarrow{AP}|}$

[13] At how many points do the spaces curves $\boldsymbol{r}_1(t) = \langle t^2,\ 1 - t^2,\ t + 1\rangle$ and $\boldsymbol{r}_2(t) = \langle 1 - t^2,\ t,\ t\rangle$ **intersect**?

A) 0 B) 1 C) 2 D) 3

[14] At time $t = 0$ you start traveling along a curve C corresponding to a vector function $\boldsymbol{r}(t)$. You know that $\boldsymbol{r'}(t) = \langle -\sin t,\ \cos t,\ 1\rangle$. What is the distance you traveled **along the curve** when $t = \pi$?

A) $\sqrt{4 + \pi^2}$ B) $\pi\sqrt{2}$ C) $\langle 0, \pi, \pi\rangle$ D) $\langle -2, 0, \pi\rangle$