King Fahd University of Petroleum and Minerals
Department of Mathematics

Math 201

Exam 1

251

1 October 2025

Net Time Allowed: 90 Minutes

USE THIS AS A TEMPLATE

Write your questions, once you are satisfied upload this file.

1. The parametric curve

$$x = \frac{t^3}{3}, \quad y = 1 + t^2 + \frac{t^4}{8}$$

is similar to ex 43, 44 sec 10.3

(a) concave upward for $t < -2$
(b) concave upward for $-1 < t < 0$
(c) concave upward for $0 < t < 1$
(d) concave downward for $t > 2$
(e) concave downward for $t > 3$

2. Which of the following sets of parametric equations describe a parabola or any part of a parabola? similar to ex 34, 20, 22, 18 8 sec 10.3

(a) $x = e^{2t}, \quad y = e^t$
(b) $x = e^{-t}, \quad y = e^{2t} - 1$
(c) $x = 2t^2, \quad y = t^4 + t$
(d) $x = \tan^2 t, \quad y = \sec^2 t$
(e) $x = 3\cos t, \quad y = 7\sin t$

3. The parametric curve

$$x = 2t^2 - 8t, \quad y = 3t^4 - 4t^3$$

has similar to ex 35, 36 sec 10.3

(a) a horizontal tangent line at the point $(-6, -1)$
(b) a vertical tangent line at the point $(0, 0)$
(c) a horizontal tangent line at the point $(-8, 16)$
(d) a vertical tangent line at the point $(2, 0)$
(e) a horizontal tangent line at the point $(6, -1)$

4. The **area** of the triangle with vertices

$$P(0, 0, 2),\ Q(1, 0, 3),\ R(-3, 2, 0)$$

is equal to similar to ex 25 sec 11.4

(a) $\frac{3}{2}$
(b) $\frac{\sqrt{11}}{2}$
(c) $\frac{5}{2}$
(d) $\frac{3\sqrt{7}}{2}$
(e) $\frac{\sqrt{80}}{2}$

5. The **slope** of the tangent line to the polar curve

$$r = 2 + 3\sin(\theta)$$

at the point corresponding to $\theta = \pi$ is equal to similar to ex 64 sec 10.4

(a) $-\frac{2}{3}$
(b) -1
(c) $-\frac{5}{2}$
(d) 0
(e) $\frac{1}{2}$

6. The polar equation $r = \dfrac{2}{1+\cos\theta}$ can be converted to the rectangular equation
similar to ex 49 sec 10.4

(a) $y^2 = 4 - 4x$
(b) $x^2 + x + y^2 = 2$
(c) $y = \dfrac{2}{1+x}$
(d) $x^2 + y^2 + 2x = 1$
(e) $x = 2$

7. The **area** of one petal of the rose curve $r = 2\cos(3\,\theta)$ is equal to similar to example 1 sec 10.5

(a) $\dfrac{\pi}{3}$
(b) $\dfrac{3\pi}{4}$
(c) $\dfrac{\pi}{6}$
(d) $\dfrac{2\pi}{3}$
(e) $\dfrac{3\pi}{7}$

8. In the xy-plane, if the vector $\vec{\mathbf{u}}$ is of magnitude 4 and makes an angle of $\dfrac{\pi}{6}$ with the positive x-axis, and the vector $\vec{\mathbf{u}} + \vec{\mathbf{v}}$ is of magnitude 6 and makes an angle of $\dfrac{2\pi}{3}$ with the positive x axis, then ex 74 sec 11.1

(a) $\vec{\mathbf{v}} =< -3 - 2\sqrt{3}\ ,\ \ 3\sqrt{3} - 2 >$
(b) $\vec{\mathbf{v}} =< 2\sqrt{3}\ ,\ \ -2\sqrt{3} >$
(c) $\vec{\mathbf{v}} =< -3 - \sqrt{3}\ ,\ \ \sqrt{3} - 2 >$
(d) $\vec{\mathbf{v}} =< -2 - 3\sqrt{3}\ ,\ \ 2\sqrt{3} - 3 >$
(e) $\vec{\mathbf{v}} =< 2, \sqrt{3} >$

9. If the points

$$P(1,-2,-k),\ Q(k-1,1,0),\ R(9,10,3k)$$

are **collinear**, then $(2k-1)^2 =$ similar to example 5 sec 11.2

(a) 49
(b) 90
(c) 81
(d) 64
(e) 36

10. If $\vec{\mathbf{u}} =< -1,2,2 >$, and $\vec{\mathbf{v}} =< 0,1,2 >$, then $\left\| \dfrac{\vec{\mathbf{u}} \times \vec{\mathbf{v}}}{\|3\vec{\mathbf{v}} - \vec{\mathbf{u}}\|} \right\| =$ (ex39,11.1) and (ex12,11.4)

(a) $\dfrac{1}{\sqrt{2}}$
(b) $\dfrac{1}{\sqrt{6}}$
(c) $\sqrt{6}$
(d) $\dfrac{2}{3\sqrt{2}}$
(e) $\dfrac{1}{2}$

11. The **area** of the region inside the polar curve $r = 2\sin\theta$ and outside $r = 2(1+\cos\theta)$ is equal to similar to ex 45 sec 10.5

(a) $4 - \pi$

(b) $2\pi - 5$

(c) $\dfrac{2\pi - 1}{8}$

(d) $2 - \dfrac{\pi}{2}$

(e) $\pi - 3$

12. The **projection** of $\vec{\mathbf{u}} =< 5, -1, -1 >$ onto $\vec{\mathbf{v}} =< -1, 5, 8 >$ is ex 44 sec 11.3

(a) $\left\langle \dfrac{1}{5},\ -1,\ -\dfrac{8}{5} \right\rangle$

(b) $\left\langle -1,\ 1,\ -\dfrac{5}{8} \right\rangle$

(c) $\left\langle \dfrac{2}{3},\ -\dfrac{2}{5},\ \dfrac{1}{8} \right\rangle$

(d) $\left\langle \dfrac{1}{3},\ -\dfrac{1}{5},\ \dfrac{1}{8} \right\rangle$

(e) $\left\langle 2,\ -\dfrac{3}{8},\ 4 \right\rangle$

13. The number of intersection points between the two polar curves

$$r = 1 - 2\ \cos\theta \quad \text{and} \quad r = 3\ \sin(\ 2\theta\ )$$

is similar to ex 51 sec 10.3 Also see Points of Intersection of Polar Graphs page 731

(a) 9
(b) 11
(c) 7
(d) 13
(e) 17

14. The **volume** of the parallelepiped with adjacent edges $\vec{\mathbf{u}}, \vec{\mathbf{v}}$, and $\vec{\mathbf{w}}$, where

$$\vec{\mathbf{u}} =< 1, 2, 1 >, \quad \text{and} \quad \vec{\mathbf{v}} \times \vec{\mathbf{w}} =< -24, -24, 24 >,$$

is equal to similar to ex 36 sec 11.4

(a) 48
(b) 24
(c) 0
(d) 36
(e) 12

15. If $\vec{\mathbf{u}}$ and $\vec{\mathbf{v}}$ are two **unit** vectors in 3D-space and

$$\vec{\mathbf{a}} = \mathrm{Proj}_{\mathrm{v}}\mathbf{u}, \quad \vec{\mathbf{b}} = \mathrm{Proj}_{\mathrm{u}}\mathbf{v},$$

then $\vec{\mathbf{a}} \cdot \vec{\mathbf{b}} =$ see ex 46 and 47 sec 11.3

(a) $(\vec{\mathbf{u}} \cdot \vec{\mathbf{v}})^3$

(b) 1

(c) 0

(d) $(\vec{\mathbf{u}} \cdot \vec{\mathbf{v}})^2$

(e) $(\vec{\mathbf{u}} + \vec{\mathbf{v}}) \cdot (\vec{\mathbf{u}} - \vec{\mathbf{v}})$