King Fahd University of Petroleum and Minerals
Department of Mathematics and Statistics

**Math 201**

**Exam I**

**182**

**Wednesday 13/2/2019**

**Net Time Allowed: 120 minutes**

# MASTER VERSION

1. The graph of the parametric curve

$$x = 1 - 2t^3, \;\; y = 1 + 2t^3, \;\; -\infty < t < \infty$$

is

(a) a straight line

(b) a parabola

(c) an ellipse

(d) a hyperbola

(e) a circle

2. A curve is given by the parametric equations $x = \cos 2t$ and $y = \sin t$, then the cartesian equation of the curve is given by:

(a) $y^2 = \dfrac{1-x}{2}$

(b) $x^2 + y^2 = 1$

(c) $y = \dfrac{x-2}{2}$

(d) $x = y^2 + 1$

(e) $y^2 = x + 1$

3. The parametric curve $C : x = \dfrac{1}{3}t^3 - t, \;\; y = t^2 - 1$ has

(a) a horizontal tangent at $(0, -1)$

(b) a vertical tangent at $(0, -1)$

(c) vertical tangents at $\left(\pm\dfrac{1}{3}, 0\right)$

(d) horizontan tangents at $\left(\pm\dfrac{2}{3}, 0\right)$

(e) a horizontal tangent at $\left(-\dfrac{4}{3}, 0\right)$

4. One of the following statements is **FALSE** with respect to the graph of $r = \cos\left(\dfrac{\theta}{3}\right), 0 \le \theta \le 3\pi$.

(a) a rose with 6 leaves

(b) symmetric with respect to the polar axis

(c) intersect itself at one point between $0 \le \theta \le 3\pi$

(d) passing through the pole

(e) directed counter clock-wise

5. The slope of the tangent line to the curve of $r = \dfrac{1}{\theta}$ at $\theta = \dfrac{\pi}{2}$ is

(a) $\dfrac{2}{\pi}$

(b) $2$

(c) $-2$

(d) $0$

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

6. The polar curves $r = k\sin\theta, k > 0$ and $r = 1 + \cos\theta$ intersect at the point $\left(\dfrac{3}{2}, \dfrac{\pi}{3}\right)$, then the value of $k$ and the other point of intersection of those curves are:

(a) $\sqrt{3}$, $(0, \pi)$

(b) $\dfrac{\sqrt{3}}{3}$, $(0, 0)$

(c) $\dfrac{\sqrt{3}}{3}$ $\left(\dfrac{1}{2}, \dfrac{2\pi}{3}\right)$

(d) $\sqrt{3}$, $\left(\dfrac{1}{2}, \dfrac{2\pi}{3}\right)$

(e) $\dfrac{\sqrt{3}}{3}$ $\left(0, \dfrac{\pi}{2}\right)$

7. The area of the region shared by

$$r = 8 \text{ and } r = 8\,(1 + \sin\theta),$$

is

(a) $16\,(5\pi - 8)$

(b) $32\,(\pi + 8)$

(c) $96\,\pi$

(d) $16\,(3\pi - 8)$

(e) $32\,\pi$

8. The length of the parametric curve $x = \dfrac{1}{3}t^3 - t,\ \ y = t^2 - 1,\ 0 \le t \le 2$, is

(a) $\dfrac{14}{3}$

(b) $\dfrac{7}{3}$

(c) $\dfrac{8}{3}$

(d) $2$

(e) $4$

9. The area of the region enclosed by one loop of the curve $r = 4\cos 3\theta$ is

(a) $\dfrac{4\,\pi}{3}$

(b) $\dfrac{8\,\pi}{3}$

(c) $\dfrac{2\,\pi}{3}$

(d) $\dfrac{\pi}{3}$

(e) $\pi$

10. The equation

$$4x^2 + 4y^2 + 4z^2 = 16\,y - 12\,z + 3$$

represents

(a) a sphere with center $\left(0, 2, -\dfrac{3}{2}\right)$ and radius $\sqrt{7}$

(b) a sphere with center $\left(0, -2, \dfrac{3}{2}\right)$ and radius $7$

(c) a sphere with center $(0, 0, 0)$ and radius $\sqrt{3}$

(d) a point

(e) no graph in $R^3$

11. $< a, b, 0 >$ is a non-zero vector perpendicular to $< 2, -1, 3 >$ then $\dfrac{a^2 + b^2}{a^2} =$

(a) 5

(b) 4

(c) 3

(d) 2

(e) 1

12. Let $\vec{u} =< 3, -1, 0 >$, and $\vec{v} =< 0, 1, 2 >$ . Then $\text{proj}_{\vec{v}}\, \vec{u} =$

(a) $\left\langle 0, \dfrac{-1}{5}, \dfrac{-2}{5} \right\rangle$

(b) $\langle 0, -1, -2 \rangle$

(c) $\left\langle \dfrac{-3}{10}, \dfrac{1}{10}, 0 \right\rangle$

(d) $\langle -3, 1, 0 \rangle$

(e) $\langle 0, 1, 2 \rangle$

13. Let $A = (1, 0, -4)$, $B = (4, 4, 8)$, and $C = (a, b, c)$ be points in three dimensional space. If $\overrightarrow{AC}$ is the unit vector in the same direction as $\overrightarrow{AB}$, then $26(a + b + c) =$

(a) $-40$

(b) $10$

(c) $20$

(d) $-4$

(e) $50$

14. A vector in two dimensional space $\vec{v}$ that makes an angle $\dfrac{\pi}{4}$ with the positive $x$-axis and with $|\vec{v}| = 6$ is given by:

(a) $v = \langle 3\sqrt{2}, -3\sqrt{2} \rangle$

(b) $v = \langle -3\sqrt{2}, -3\sqrt{2} \rangle$

(c) $v = \langle 6, 0 \rangle$

(d) $v = \langle -3\sqrt{2}, 3\sqrt{2} \rangle$

(e) $v = \langle 3\sqrt{3}, -3 \rangle$

15. If the angle between the vectors $\langle 1, 1, -2\rangle$ and $\langle 1, x, 0\rangle$ is $60°$, then the sum of all possible values of $x$ is

(a) 4

(b) 2

(c) 0

(d) $-2$

(e) $-4$

16. If the unit vectors that are parallel to the tangent line to the curve $y = 2\sin x$ at the point $x = \dfrac{5\pi}{6}$ are given by $\vec{u} = \pm\dfrac{1}{a}(i + bj), a > 0$ then $a + \sqrt{3}\,b = \ldots$

(a) $-1$

(b) 1

(c) 5

(d) $-5$

(e) $-2$

17. The set of all points equidistant from the points $A(1,-7,2)$ and $B(3,1,-1)$ is
**(perp stands for perpendicular)**

(a) a plane perp to the line $AB$, with equation $4x+16y-6z=-43$

(b) a plane perp to the line $AB$, with equation $2x+8y-3z=22$

(c) any line perp to the line $AB$

(d) only the point $(2,-3,\frac{1}{2})$

(e) a line perp to the line $AB$, and passing through the point $(2,-3,\frac{1}{2})$

18. If $\theta$ is the angle between the nonzero vectors $\vec{a}$ and $\vec{b}$, then $\cot\theta =$

(a) $\dfrac{a\cdot b}{|a\times b|}$

(b) $\dfrac{|a\times b|}{a\cdot b}$

(c) $\dfrac{a\cdot b}{|a||b|}$

(d) $\dfrac{|a\times b|}{|a||b|}$

(e) $(a\cdot b)|a\times b|$

19. A vector $\vec{V}$ such that

$$\langle 1, 2, 1\rangle \times \vec{V} = \langle 3, 1, 5\rangle$$

is:

(a) there is no such vector

(b) $\langle 1, -3, 0\rangle$

(c) $\langle -1, -7, -2\rangle$

(d) $\langle 2, -1, 1\rangle$

(e) $\langle 5, 5, 4\rangle$

20. The area enclosed by the three polar curves $r = \dfrac{-1}{\sin\theta + \cos\theta}$, $\theta = \pi( r \geq 0)$, and $\theta = \dfrac{\pi}{2}(r \leq 0)$ equals

(a) $\dfrac{1}{2}$

(b) $1$

(c) $2$

(d) $\sqrt{2}$

(e) $2\sqrt{2}$

**Answer KEY**

| Q | MM | V1 | V2 | V3 | V4 |
|---|---|---|---|---|---|
| 1 | a | d | b | a | e |
| 2 | a | e | e | a | b |
| 3 | a | b | c | d | b |
| 4 | a | e | e | c | c |
| 5 | a | b | e | b | d |
| 6 | a | c | b | a | c |
| 7 | a | e | a | b | e |
| 8 | a | b | e | d | c |
| 9 | a | d | a | b | c |
| 10 | a | b | b | a | b |
| 11 | a | b | b | b | c |
| 12 | a | b | d | e | a |
| 13 | a | c | c | c | a |
| 14 | a | e | c | e | a |
| 15 | a | b | b | c | b |
| 16 | a | b | e | d | e |
| 17 | a | e | b | e | d |
| 18 | a | b | a | a | c |
| 19 | a | a | c | e | a |
| 20 | a | b | c | a | c |