Name: _____

Instructor: _____

Math 10560, Exam Questions 8.1
February 18, 3000

- For realistic exam practice solve these problems without looking at your book
- and without using a calculator.
- Multiple choice questions should take about 4 minutes to complete.
- Partial credit questions should take about 8 minutes to complete.

PLEASE MARK YOUR ANSWERS WITH AN X, not a circle!

1.	(a)	(b)	(c)	(d)	(e)
2.	(a)	(b)	(c)	(d)	(e)
3.	(a)	(b)	(c)	(d)	(e)
4.	(a)	(b)	(c)	(d)	(e)
5.	(a)	(b)	(c)	(d)	(e)
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8.	(a)	(b)	(c)	(d)	(e)
9.	(a)	(b)	(c)	(d)	(e)

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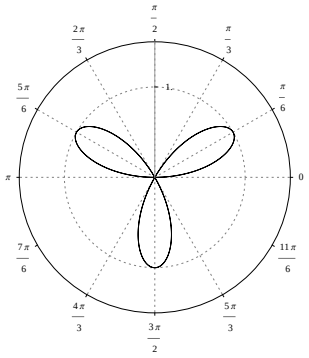
Multiple Choice

1.(6 pts) Which integral below gives the area inside the polar curve $r = \sin(3\theta)$?



(a) $\dfrac{1}{2}\displaystyle\int_0^{\pi} \sin^2(3\theta)\ d\theta$

(b) $\dfrac{1}{2}\displaystyle\int_0^{\pi} \sqrt{\sin^2(3\theta) + 9\cos^2(3\theta)}\ d\theta$

(c) $\dfrac{1}{2}\displaystyle\int_0^{2\pi} \sqrt{\sin^2(3\theta) + 9\cos^2(3\theta)}\ d\theta$

(d) $\dfrac{1}{2}\displaystyle\int_{\pi/6}^{\pi/3} \sin^2(3\theta)\ d\theta$

(e) $\dfrac{1}{2}\displaystyle\int_0^{2\pi} \sin^2(3\theta)\ d\theta$

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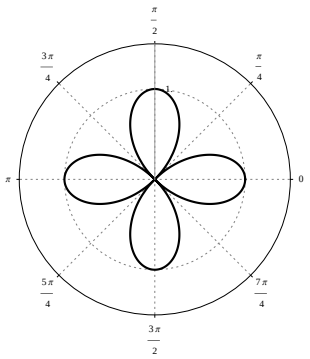
2.(6 pts) Find the area of the region enclosed by the polar curve $r = \cos(2\theta), \;\; 0 \leq \theta \leq 2\pi$. (Note: The formula sheet may help here.)



(a) 2 (b) $\dfrac{\pi^2}{2}$ (c) π (d) $\dfrac{\pi}{2}$ (e) 2π

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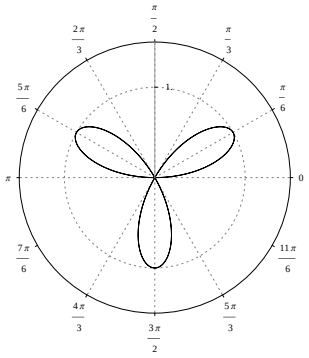
3.(6 pts) Find the area of the region enclosed by the polar curve

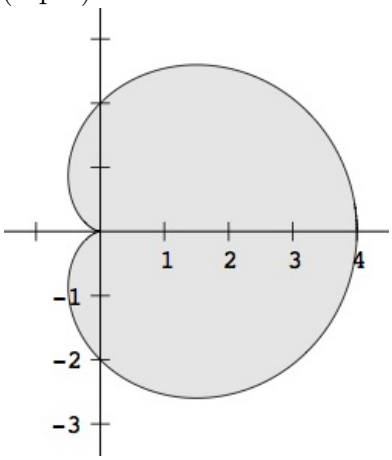
$$r = \sin(3\theta), \quad 0 \le \theta \le \pi.$$

(**Note:** The formula sheet may help here.)



(a) π (b) $\frac{\pi}{3}$ (c) $\frac{\pi}{4}$ (d) $\frac{\pi}{2}$ (e) 3

4.(6 pts) Find the area inside the cardioid $r = 2 + 2\cos\theta$.



(a) 6π (b) 8 (c) 8π (d) $3\pi + \ln 4$ (e) 6

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5.(6 pts) Which integral below gives the arc length of the polar curve $r = \sin\theta\cos\theta$ for $0 \le \theta \le \pi$?

(a) $\int_0^\pi \sqrt{\sin^2\theta + \cos^2\theta - \sin\theta\cos\theta}\, d\theta$

(b) $\int_0^\pi \sqrt{1 + \sin^4\theta + \cos^4\theta - 2\sin^2\theta\cos^2\theta}\, d\theta$

(c) $\int_0^\pi \frac{1}{2}\sin^2\theta\cos^2\theta\, d\theta$

(d) $\int_0^\pi \sqrt{\sin^4\theta + \cos^4\theta - \sin^2\theta\cos^2\theta}\, d\theta$

(e) $\int_0^\pi \sqrt{1 + \sin^2\theta\cos^2\theta}\, d\theta$

6.(6 pts) Find the arc length of the curve with polar equation: $r = 2 - 2\cos\theta, \quad 0 \le \theta \le 2\pi$.

(a) 34 (b) 12 (c) 8 (d) 16 (e) 32

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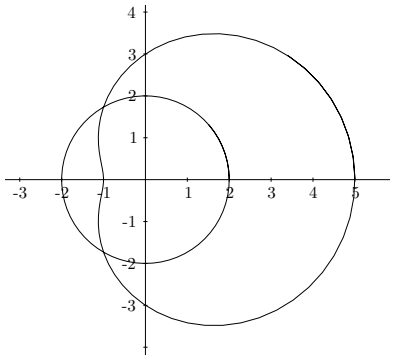
7.(6 pts) The area inside the curve $r = 3 + 2\cos\theta$ and outside the circle $r = 2$ is given by which integral below?



Hint: The region is symmetric with respect to the x-axis.

(a) $\displaystyle\int_0^{\frac{2\pi}{3}} \left(12 + 5\cos\theta + 4\cos^2\theta\right) d\theta$

(b) $\displaystyle\int_0^{\frac{\pi}{3}} \left(5 + 12\cos\theta + 4\cos^2\theta\right) d\theta$

(c) $\displaystyle\int_0^{\frac{\pi}{3}} \left(12 + 5\cos\theta + 4\cos^2\theta\right) d\theta$

(d) $\displaystyle\frac{1}{2}\int_0^{\frac{2\pi}{3}} \left(5 + 12\cos\theta + 4\cos^2\theta\right) d\theta$

(e) $\displaystyle\int_0^{\frac{2\pi}{3}} \left(5 + 12\cos\theta + 4\cos^2\theta\right) d\theta$

8.(6 pts) Find the slope of the tangent line to the curve $r = 3\sin\theta$ at $\theta = 0$.
Hint: A polar curve is also a parametrized curve.

(a) -1 (b) 1 (c) 2 (d) π (e) 0

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9.(6 pts) Find the arc length of the curve with polar equation:

$$r = \theta^2 \quad \text{for } 0 \leq \theta \leq 2\pi.$$

(a) $16(\pi^{3/2} - 1)$ (b) $\frac{8}{3}\left((\pi^2 + 1)^{3/2} - 1\right)$ (c) $4\sqrt{2\pi}$

(d) $\frac{2}{3}\pi^{3/2}$ (e) $\frac{1}{8}\left(\sqrt{\pi^2 + 1}^{-1} - 1\right)$

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The following is the list of useful trigonometric formulas:

$$\sin^2 x + \cos^2 x = 1$$

$$1 + \tan^2 x = \sec^2 x$$

$$\sin^2 x = \frac{1}{2}(1 - \cos 2x)$$

$$\cos^2 x = \frac{1}{2}(1 + \cos 2x)$$

$$\sin 2x = 2 \sin x \cos x$$

$$\sin x \cos y = \frac{1}{2}\big(\sin(x - y) + \sin(x + y)\big)$$

$$\sin x \sin y = \frac{1}{2}\big(\cos(x - y) - \cos(x + y)\big)$$

$$\cos x \cos y = \frac{1}{2}\big(\cos(x - y) + \cos(x + y)\big)$$

$$\int \sec \theta = \ln |\sec \theta + \tan \theta| + C$$

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