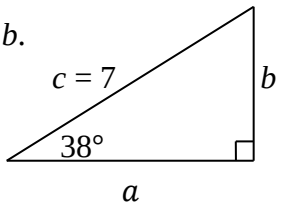
Math 111 – Final Exam – Fall 2011

No books, notes, or calculators allowed.
Do NOT write on this exam.

1. In the given right triangle $c = 7$ and $B = 38°$. Find the length of leg *b*.



(Drawing not to scale)

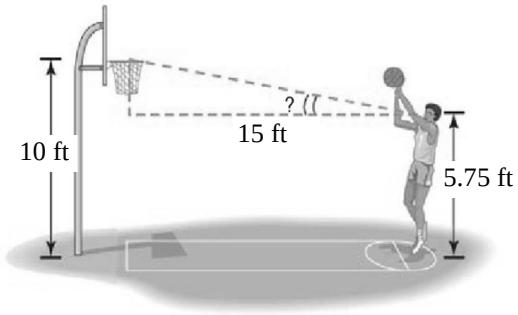
(a) $7\tan 38°$ (b) $7\sec 38°$ (c) $7\sin 38°$

(d) $7\csc 38°$ (e) $7\cos 38°$ (f) $7\cot 38°$

2. Use fundamental identities and/or the complementary angle theorem to find the value of the following expression: $\frac{1}{\sin(78°)} - \sec(12°)$.

(a) $\frac{1}{2}$ (b) $\frac{\sqrt{3}}{2}$ (c) $\csc(78°)$ (d) $-\sec(12°)$ (e) 0 (f) 1

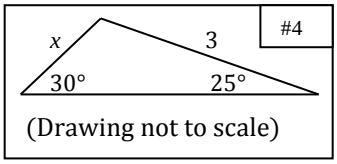
3. When basketball player Jimmer Fredette is standing up straight, his eyes are about 5.75 feet (or 5 ft 9 in) above the floor. If the free-throw line on the court is 15 feet from the center of the basket rim, and the rim is 10 feet above the floor (see figure). When he is standing at the free-throw line, what is the angle of elevation from Jimmer's eyes to the center of the rim?



(a) $\tan^{-1}\left(\frac{4.25}{15}\right)$ (b) $\tan^{-1}\left(\frac{10}{15}\right)$ (c) $\frac{4.25}{15}$

(d) $\tan^{-1}\left(\frac{15}{4.25}\right)$ (e) $\tan^{-1}\left(\frac{5.75}{10}\right)$ (f) $\sin^{-1}\left(\frac{10}{15}\right)$

4. Given the following triangle, find the measure of the missing side length *x*. Simplify where possible.



(Drawing not to scale)

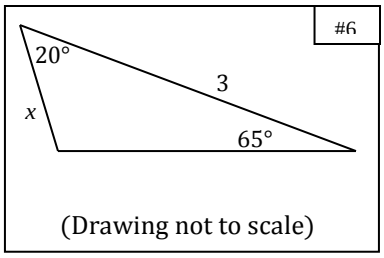
(a) $6\cos 25°$ (b) $2\sqrt{3}\sin 25°$ (c) $3\sin 25°$

(d) $6\sin 125°$ (e) $6\sin 25°$ (f) $6\sin 30°$

5. Scott is trying to make a triangle with sides *a*, *b*, and *c* so that $b = 4$, $c = 5$, and $C = 30°$. How many triangles does the given information produce? (assume that in this triangle, side *a* opposite of angle *A*, side *b* is opposite of angle *B*, and side *c* is opposite of angle *C*)

(a) No triangles (b) One triangle (c) Two triangles
(d) None of these (e) Not enough information to tell

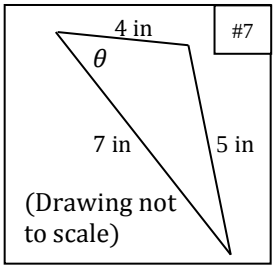
6. Given the following triangle, find the measure of the missing side length *x*. Simplify where possible.



(a) $3\sin\left(\frac{65°}{95°}\right)$ (b) $\frac{3\sin 20°}{\sin 65°}$ (c) $\frac{3\sin 65°}{\sin 95°}$

(d) $\frac{\sin 20°}{\sin 65°}$ (e) $\frac{3\sin 65°}{\sin 20°}$ (f) $\frac{\sin 95°}{3\sin 65°}$

7. Given the following triangle, use the law of cosines to find the measure of the missing angle θ. Simplify where possible.

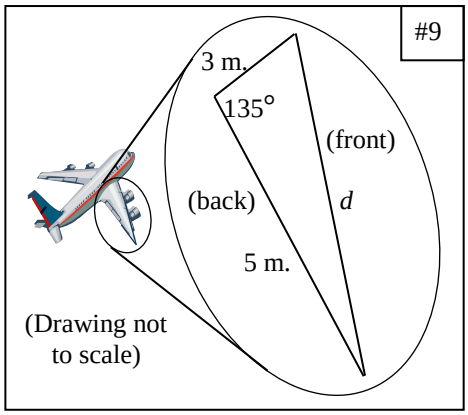


(a) $\cos^{-1}\left(-\frac{25}{9}\right)$ (b) $\cos^{-1}\frac{5}{14}$ (c) $\cos^{-1}\frac{16}{49}$ (d) $\cos^{-1}\frac{5}{7}$ (e) none of these

8. Use Heron's Formula to find the area of the triangle described and shown in the previous problem (#7).

(a) 10 in^2 (b) $24\sqrt{6}\text{ in}^2$ (c) 8 in^2 (d) $2\sqrt{3}\text{ in}^2$ (e) $4\sqrt{6}\text{ in}^2$ (f) none of these

9. Travis is trying to build a small plane and he is sketching the right wing. He wants the length where the wing attaches to be 3 meters, and the distance from the tip of the wing to where the back part of the wing attaches to the plane to be 5 meters. He also wants the angle between the attached part of the wing and the back part of the wing to be 135°. Find the distance (*d*) from the tip of the wing to where the wing attaches at the front of the plane (see the figure).



(b) $34+15\sqrt{2}$ m. (b) $\sqrt{34-15\sqrt{2}}$ m. (c) 19 m.

(d) $\sqrt{34+15\sqrt{2}}$ m. (e) $\sqrt{34-\frac{15\sqrt{2}}{2}}$ m. (f) $19\sqrt{2}$ m.

10. Find the area of the airplane wing sketch described and shown in the previous problem (#8).

(a) $\frac{15\sqrt{2}}{4}\text{ m}^2$ (b) $\frac{15\sqrt{2}}{2}\text{ m}^2$ (c) $15\sqrt{2}\text{ m}^2$ (d) 15 m^2 (e) $\frac{15\sqrt{3}}{2}\text{ m}^2$ (f) none of these

11. An object attached to a coiled spring is pulled down 7 inches from its rest position and then released. The object is oscillating under simple harmonic motion (ignoring all external forces), and it takes 4 seconds for the weight to go up and back down (one full oscillation). Find the equation *d(t)* in inches that describes the position of the object after *t* seconds (assume the positive direction of motion is up).

(a) $d(t)=7\cos\left(\frac{\pi}{2}t\right)$ (b) $d(t)=-7\cos\left(\frac{\pi}{2}t\right)$ (c) $d(t)=-4\cos\left(\frac{\pi}{2}t\right)$ (d) $d(t)=-7\cos(4t)$

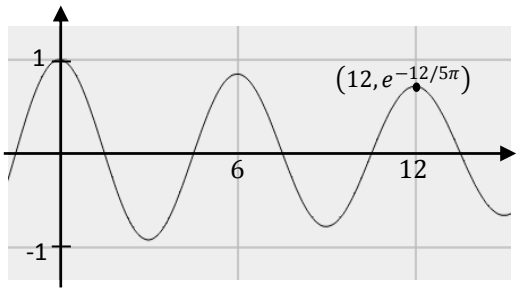
12. A pendulum object with a mass of 5 grams is pulled to the right (the positive direction of motion) 4 meters of its rest position and then released. There is a damping factor of 0.8 grams/second. If it takes the object 3 seconds to go one full oscillation (under simple harmonic motion). Write an equation that relates the displacement $d(t)$ (in meters) of the object from its rest position after t seconds.

(a) $d(t) = -4e^{-0.8t/5}\cos\left(\sqrt{3^2 - \frac{(0.8)^2}{25}}\,t\right)$ (b) $d(t) = 4e^{-0.8t/5}\cos\left(\sqrt{\left(\frac{2\pi}{3}\right)^2 - \frac{(0.8)^2}{25}}\,t\right)$

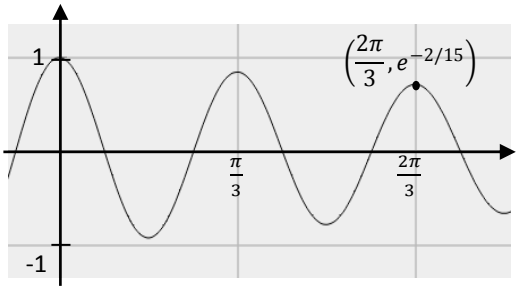
(c) $d(t) = -4e^{-10t/0.8}\cos\left(\sqrt{\left(\frac{2\pi}{3}\right)^2 - \frac{25}{4(0.8)^2}}\,t\right)$ (d) $d(t) = 4e^{-0.8t/10}\cos\left(\sqrt{\left(\frac{2\pi}{3}\right)^2 - \frac{(0.8)^2}{100}}\,t\right)$

13. Sketch the graph of the following damped vibration curve: $d(t) = e^{-t/5\pi}\cos\left(\frac{\pi}{3}t\right)$

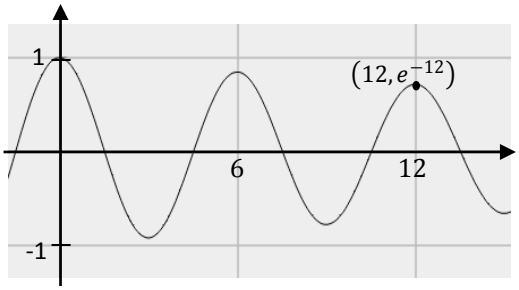
(a)



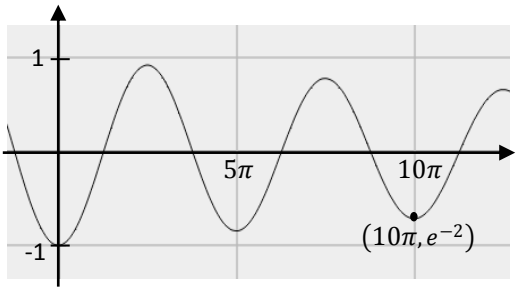
(b)



(c)



(d)



14. Which of the following polar coordinates describe the same point as the point $\left(-7, -\frac{\pi}{4}\right)$ given in polar coordinates.

(a) $\left(7, \frac{3\pi}{4}\right)$ (b) $\left(-7, -\frac{5\pi}{4}\right)$ (c) $\left(-7, \frac{\pi}{4}\right)$ (d) $\left(7, \frac{\pi}{4}\right)$ (e) none of these

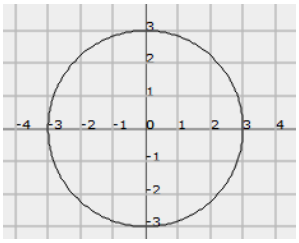
15. Identify the polar coordinates of the point whose rectangular coordinates are $\left(5\sqrt{3}, -5\right)$.

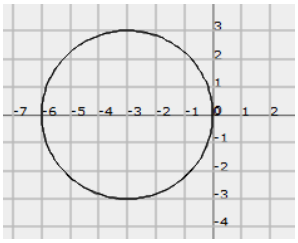
(a) $\left(2\sqrt{5}, \frac{7\pi}{4}\right)$ (b) $\left(2\sqrt{5}, -\frac{\pi}{4}\right)$ (c) $\left(10, -\frac{\pi}{6}\right)$ (d) $\left(10, -\frac{\pi}{3}\right)$ (e) none of these

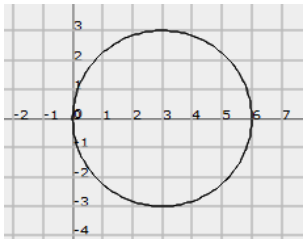
16. Convert the following equation from an equation using rectangular coordinates to an equation using polar coordinates: $3x^2 + 3y^2 = 2y$

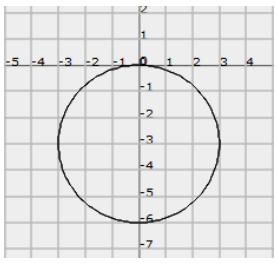
(a) $3r^2 - 2r\cos\theta = 0$ (b) $3r^2 - 2r\sin\theta = 0$
(c) $3r\sin\theta - 2r = 0$ (d) none of these

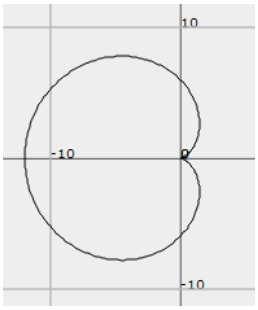
17. Identify the graph of the following polar equation: $r = -6\cos\theta$

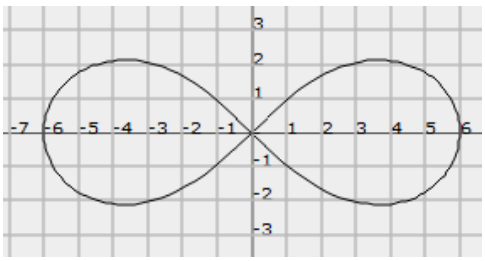
(a) 

(b) 

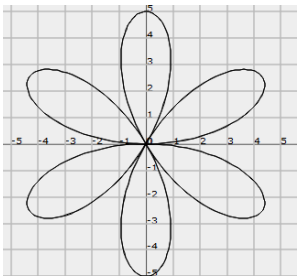
(c) 

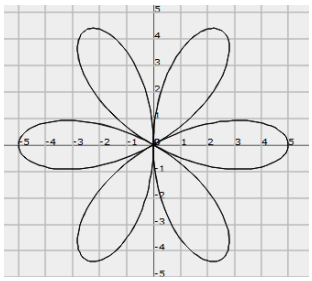
(d) 

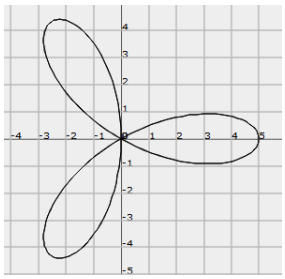
(e) 

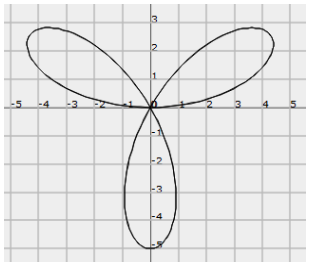
(f) 

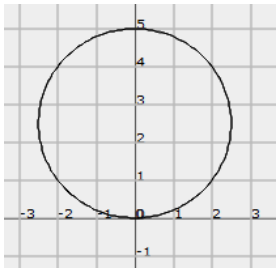
18. Identify the graph of the following polar equation: $r = 5\sin(3\theta)$

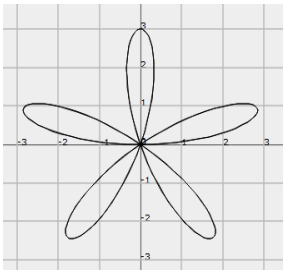
(a) 

(b) 

(c) 

(d) 

(e) 

(f) 

19. Convert the complex number $z = 10(\cos 225° + i\sin 225°)$ given in polar form to rectangular form.

(a) $-5\sqrt{2} - 5\sqrt{2}i$ (b) $-5 - 5i$

(c) $5\sqrt{2} + 5\sqrt{2}i$ (d) $5 + 5i$

20. Using De Moivre's Theorem, identify the complex number $\left[2\left(\cos\left(\frac{4\pi}{27}\right) + i\sin\left(\frac{4\pi}{27}\right)\right)\right]^3$ written in the standard polar form.

(a) $\frac{2}{3}\left[\cos\left(\frac{4\pi}{81}\right) + i\sin\left(\frac{4\pi}{81}\right)\right]$ (b) $4\left[\cos\left(\frac{8\pi}{27}\right) + i\sin\left(\frac{8\pi}{27}\right)\right]$ (c) $8\left[\cos\left(\frac{4\pi}{9}\right) + i\sin\left(\frac{4\pi}{9}\right)\right]$

(d) $6\left[\cos\left(\frac{4\pi}{9}\right) + i\sin\left(\frac{4\pi}{9}\right)\right]$ (e) $6\left[\cos\left(\frac{4\pi}{27}\right) + i\sin\left(\frac{4\pi}{27}\right)\right]$ (f) $8[\cos(12\pi) + i\sin(12\pi)]$

Answers:

1. C
2. E
3. A
4. E
5. B
6. C
7. D
8. E
9. D
10. A
11. B
12. D
13. A
14. A
15. C
16. B
17. B
18. D
19. A
20. C