

The “No Calculators” Pages

**Instructions:** See front page for general instructions. Finish this page before going to the rest. You may not return to this page once you turn on your calculator.

N1.) (12 points) Find exact algebraic values for each of the following, where defined. Otherwise, write “undefined.” 12

(a)  $\tan 135^\circ$

(e)  $\cot(-90^\circ)$

(i)  $\cot \pi/3$

(b)  $\sin 120^\circ$

(f)  $\tan 4\pi/3$

(j)  $\tan 270^\circ$

(c)  $\cos(-90^\circ)$

(g)  $\sec 30^\circ$

(k)  $\csc 5\pi/6$

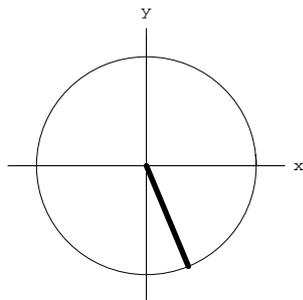
(d)  $\cos(150^\circ)$

(h)  $\csc 315^\circ$

(l)  $\cos 3\pi/4$

(★) Give exact algebraic value for  $\sin(720720360720360360720720720300^\circ)$ .

N2.) (8 points) An angle  $\theta$  is shown in standard position. Give approximate values for  $\sin \theta$  and  $\cos \theta$ . 20



$\sin \theta \approx$
$\cos \theta \approx$

N3.) (10 points) For each below, circle the inequality ( $<$  or  $>$ ) that makes the statement true. 30  
*Incorrect answers will be awarded negative points to discourage random guessing.* (So perhaps you should leave an answer blank if you have no idea.)

(a)  $\sin 66^\circ < > \sin 67^\circ$

(f)  $\cos 83^\circ < > \cos 93^\circ$

(b)  $\sin 155^\circ < > \sin 156^\circ$

(g)  $\tan 200^\circ < > \tan 222^\circ$

(c)  $\sin 244^\circ < > \sin 245^\circ$

(h)  $\tan 75^\circ < > \tan^2 75^\circ$

(d)  $\sin 333^\circ < > \sin 334^\circ$

(i)  $\tan 125^\circ < > \sec 25^\circ$

(e)  $\cos 77^\circ < > \cos 88^\circ$

(j)  $\sec 2^\circ < > \cos 2^\circ$

N4.) (6 points) Write the *exact algebraic values* of the functions  $\sin \theta$ ,  $\cos \theta$  and  $\tan \theta$  for the angle  $\theta$  in standard position having the point  $(\sqrt{5}, -2)$  on its terminal side. 36

$\sin \theta =$

$\cos \theta =$

$\tan \theta =$

Test #1

**Instructions:** Answer all problems correctly. Calculators are allowed (except on the “No Calculators Page”) but *they must not be used to retrieve information or formulas*. Feel free to leave numerical answers in “calculator-ready form.” Each starred problem is extra credit, and each  $\star$  is worth 5 points.

The phrase *exact algebraic values* appears throughout the test. Quantities such as  $\sqrt{3}$ ,  $5/3$ , etc., are exact algebraic values, as opposed to *numerical approximations*, such as 1.732, 1.666, etc., which are not.

A maximum of 115 points (out of 100) will be awarded on this test. Enjoy.

1. (6 points) The terminal side of an angle  $\theta$  in standard position lies on the line  $4y + 5x = 0$ , with  $x < 0$ . Find exact algebraic values for  $\cos \theta$  and  $\tan \theta$ .

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$\cos \theta =$
$\tan \theta =$

2. (6 points) Write

48

(a) a reciprocal identity involving  $\sec \theta$ ,

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(b) a Pythagorean identity involving  $\sec \theta$ ,

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(c) a cofunction identity involving  $\sec \theta$ .

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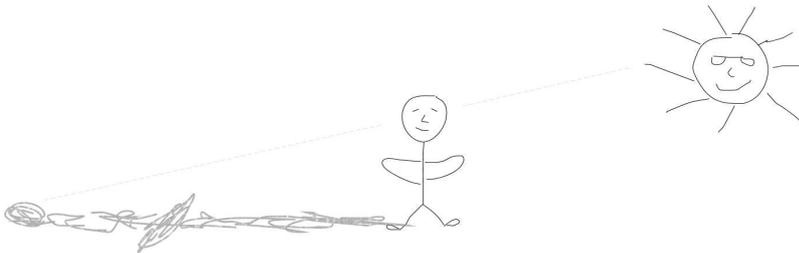
3. (9 points) Assuming  $\sin \theta = 3/4$ , and  $\theta \in \text{QII}$ , give exact algebraic values for the following.

(a)  $\cos \theta$

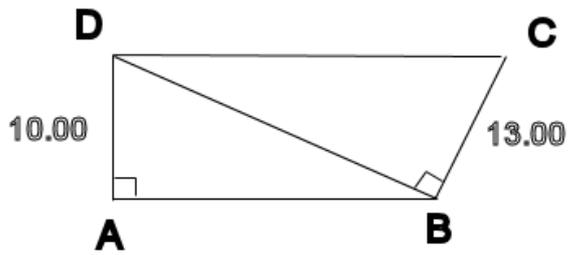
(b)  $\tan \theta$

(c)  $\csc \theta$

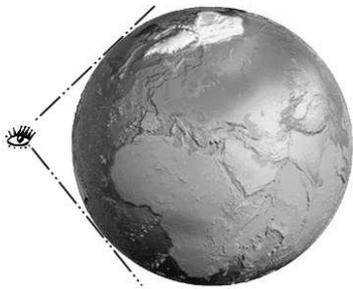
4. (8 points) A child standing exactly four feet tall stands in the morning sun when the sun has an angle of elevation of just  $10.0^\circ$ . How long is the child's shadow on the ground?



5. (8 points) In the figure below,  $\angle DAB = 90^\circ$ ,  $\angle DBC = 90^\circ$  and  $\angle BCD = 70^\circ$ . Find the length of segment  $\overline{AB}$ . 73




6. (8 points) At a point 1320 miles from the surface of the earth, how big does the earth look? (Answer this as an angle, the angular “field of view”, which is the measure of the angle formed at the eye by two tangent lines drawn to opposite points on the visible disk of the sphere. You need to know the radius of the earth for this one, too. Use 4000 miles if you don’t remember the more exact number, but that will cost you a point.) 81



7. (8 points) A tourist views the Eiffel tower, which has a height of about 986 feet, and the tourist measures the angle of elevation top of the tower to be  $13.6^\circ$ . The tourist then approaches the tower directly until the distance to the base of the tower is half of what it was previously. What is the new angle of elevation to top of the tower?

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8. (6 points) A tractor's tire measures 26.5 inches in radius. How far does the tractor move if the tire rotates through an angle of  $55^\circ$ ?

95

9. (6 points) Two pulleys are connected by a belt. The radii of the pulleys are 8.00 inches and 12.00 inches. If the smaller pulley rotates at a rate of  $\omega = 144^\circ$  per second, how fast does the larger pulley rotate?

101

10. (6 points) Shreveport is at latitude  $32.2^\circ\text{N}$ . How far is Shreveport from the Tropic of Capricorn, which is at  $23.5^\circ\text{S}$ ? 107

11. (16 points) A ship leaves port and travels for 5.3 miles with a bearing of  $\text{S}23^\circ\text{E}$ . The ship then travels 2.9 miles with a bearing of  $\text{N}38^\circ\text{E}$ . 123

(a) How far is the ship from port?

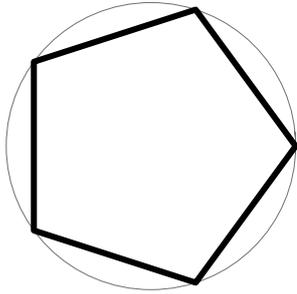
(b) What is the new bearing of the ship as measured from the port?

\*\*\* Extra Credit \*\*\*

(You may do these on the back of the previous page if you wish.)

- A.) (8 points) Find the area  $A$  of a regular pentagon inscribed in a circle of radius  $R$ .

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- B.) In problem #5, suppose that instead of specifying  $\angle BCD$ , we are told only that segments  $\overline{CD}$  and  $\overline{AB}$  are parallel. Find the length of  $\overline{AB}$ .

- C.) (★) Find any solution  $(x, y)$  to the following equation.

$$\cos(4x + y) = \csc(2y + 22.0^\circ)$$

D.) (★) A parallelogram has sides measuring 33.3 inches and 22.2 inches, and has an acute angle of  $11.1^\circ$ . Find the length of the short diagonal of the parallelogram.

E.) (★) Write an equation for the line passing through the point  $(2, 3)$  and making a *counterclockwise* angle of  $43^\circ$  with respect to the positive  $y$ -axis (with the positive  $y$ -axis as the initial side of the angle).

F.) (★) Prove the following classical fact of geometry: On a circle, let  $A$  and  $B$  denote the endpoints of a diameter. Let  $C$  denote any other point on the circle. Then the angle at  $C$  in  $\triangle ABC$  is a right angle. (You can use some trig to prove this but there is a way to do it by simply summing angles in triangles.)

G.) (★...★) Ask a question you wish I had asked and answer it. Points will vary.