Math 51 (7:30am – 8:20am)
Midterm 2
Thu May 14, 2009

WHITE + BLUE

SCORE: ___ / 140 POINTS

What month is your birthday ? ___ ___
What are the first 2 digits of your address ? ___ ___
What are the last 2 digits of your zip code ? ___ ___
What are the last 2 digits of your social security number ? ___ ___
[IF YOU DO NOT HAVE A SOCIAL SECURITY NUMBER, USE YOUR STUDENT ID NUMBER]

NO CALCULATORS ALLOWED ON THIS SECTION

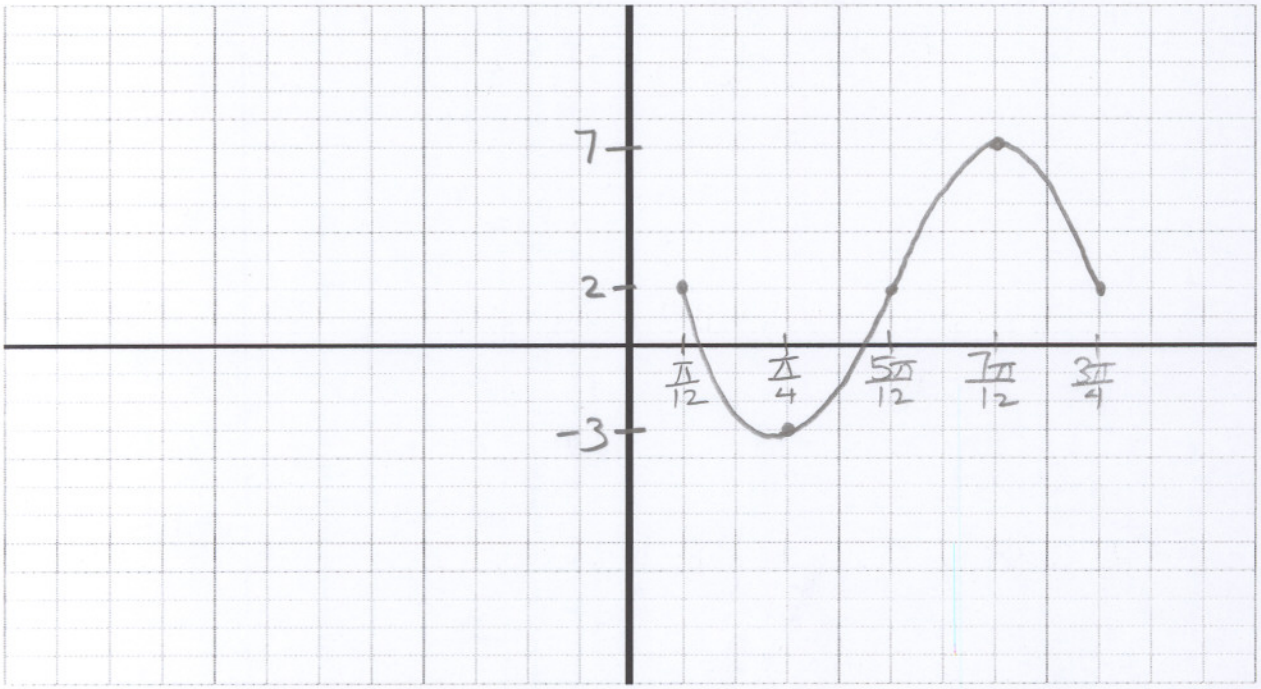
Fill in the circular function values. **SCORE: ___ / 12 POINTS**

$\tan\frac{\pi}{3} = \sqrt{3}$ $\cos\frac{\pi}{2} = 0$ $\csc\frac{\pi}{4} = \sqrt{2}$ $\sin\frac{\pi}{6} = \frac{1}{2}$

Find the circular function values. **SCORE: ___ / 12 POINTS**

$\cos\frac{11\pi}{6} = \frac{\sqrt{3}}{2}$ $\sin\frac{10\pi}{3} = -\frac{\sqrt{3}}{2}$ $\tan\frac{7\pi}{4} = -1$

Graph **one period** of $y = -5\sin\left(3x - \frac{\pi}{4}\right) + 2$. Label all relevant x- and y-values discussed in class. **SCORE: ___ / 24 POINTS**



AMPLITUDE = 5

PERIOD = $\frac{2\pi}{3}$ $\frac{1}{4}$ PERIOD = $\frac{\pi}{6}$

MIDLINE $y = 2$ → MAX $y = 2+5 = 7$, MIN $y = 2-5 = -3$

PHASE SHIFT = $\frac{-\left(\frac{-\pi}{4}\right)}{3} = \frac{\pi}{12}$

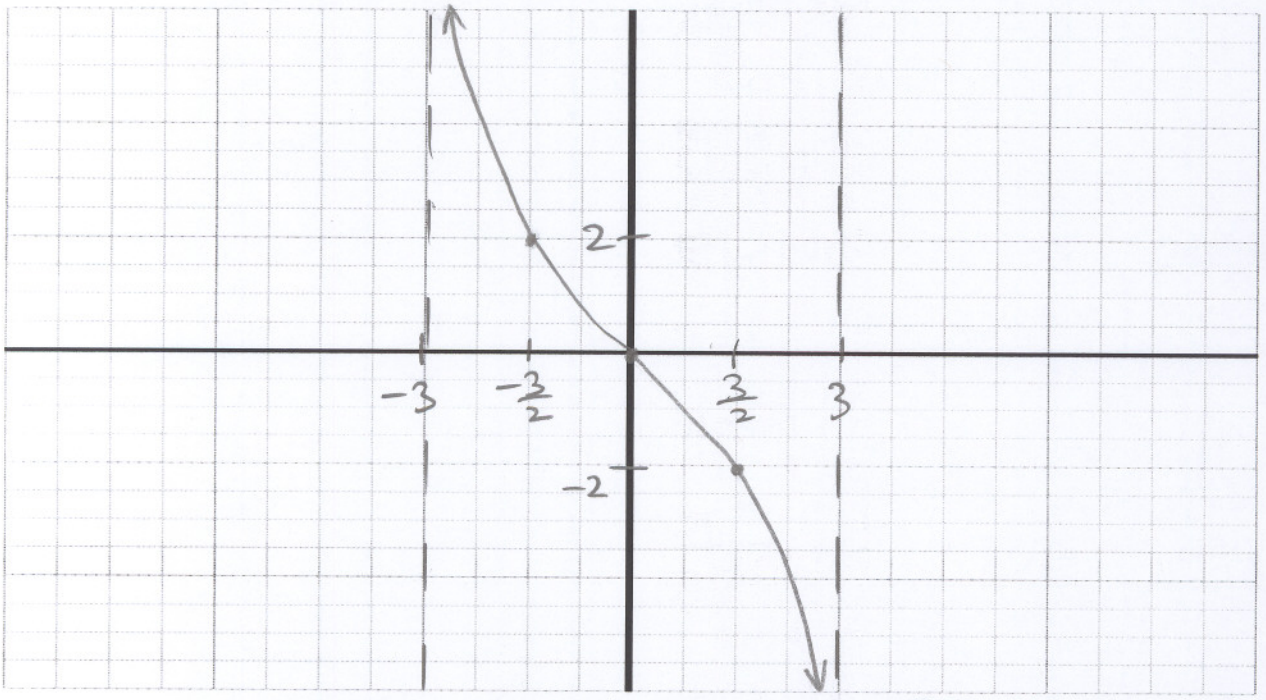
$\frac{\pi}{12} + \frac{\pi}{6} = \frac{\pi}{12} + \frac{2\pi}{12} = \frac{3\pi}{12} = \frac{\pi}{4}$

$+\frac{2\pi}{12} = \frac{5\pi}{12}$

$+\frac{2\pi}{12} = \frac{7\pi}{12}$

$+\frac{2\pi}{12} = \frac{9\pi}{12} = \frac{3\pi}{4}$

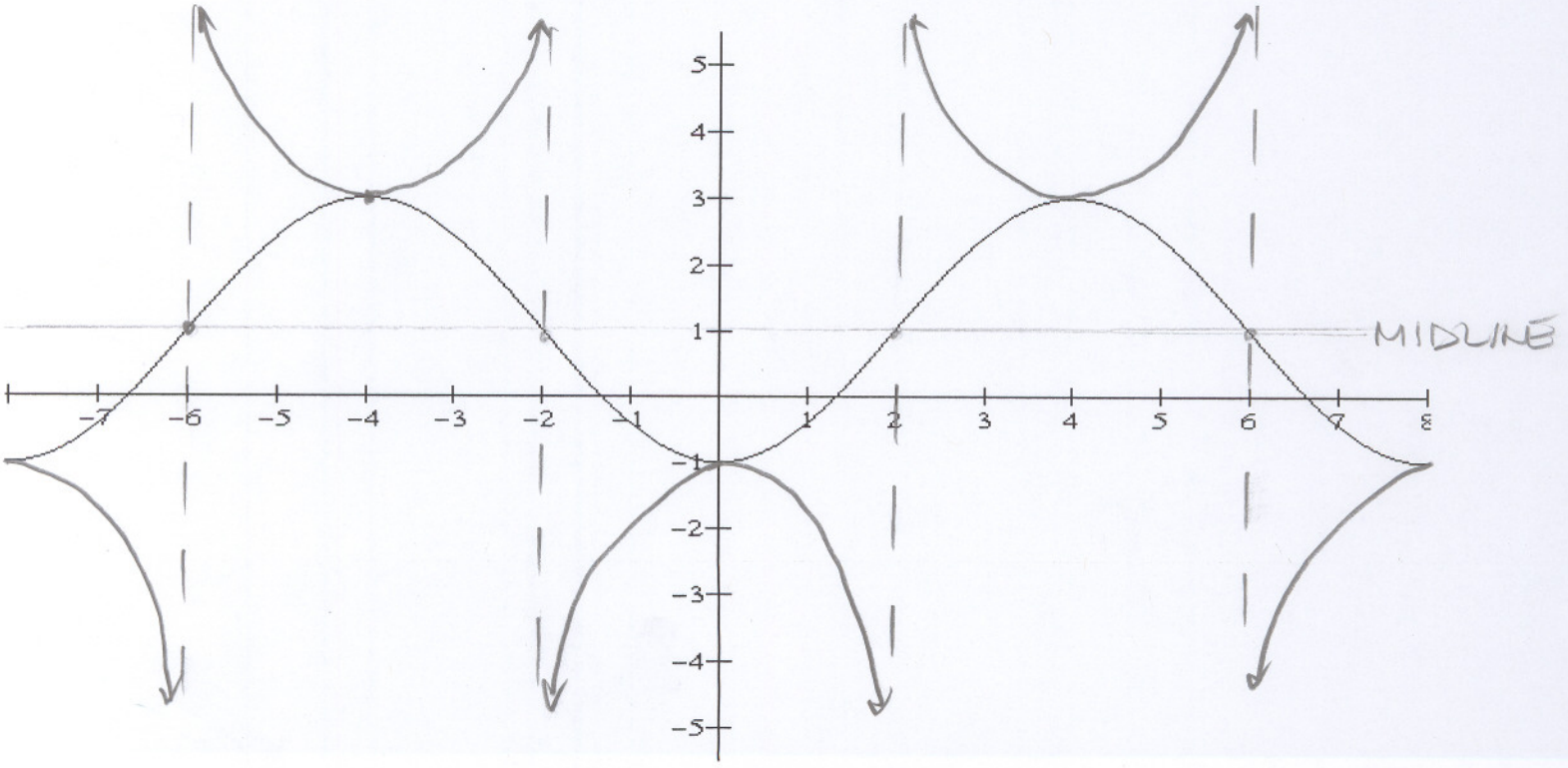
Graph **one period** of $y = -2\tan\frac{\pi x}{6}$. Label all relevant x- and y-values discussed in class. **SCORE: ___ / 16 POINTS**



PERIOD $= \frac{\pi}{\frac{\pi}{6}} = 6$ $\quad \frac{1}{4}$ PERIOD $= \frac{3}{2}$

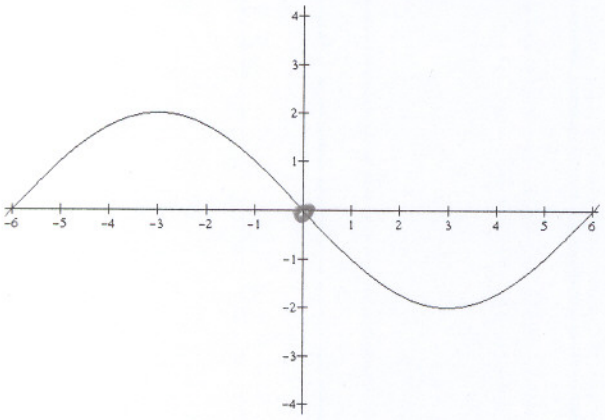
$a = -2$

The graph of $y = -2\cos\left(\frac{\pi x}{4}\right)+1$ is shown below. Sketch the graph of $y = -2\sec\left(\frac{\pi x}{4}\right)+1$ on the axes below. **SCORE: ___ / 10 POINTS**



Find an equation of the form $y = a\sin bx$ or $y = a\cos bx$ for the graph below. **SCORE: ___ / 12 POINTS**

SHOW HOW YOU GOT YOUR ANSWER.



AMPLITUDE $= 2 = |a|$

$a = \pm 2$

UPSIDE DOWN SINE $\Rightarrow a = -2$

PERIOD $= 6 - (-6) = 12 = \frac{2\pi}{b}$

$12b = 2\pi$

$b = \frac{\pi}{6}$

$y = -2\sin\frac{\pi}{6}x$

Find the exact value of s in $\left[\frac{3\pi}{2}, 2\pi\right]$ such that $\tan s = -\sqrt{3}$. **SCORE: ___ / 6 POINTS**

$s = 2\pi - \frac{\pi}{3} = \frac{5\pi}{3}$

MULTIPLE CHOICE: Which of the following quantities is positive ? **SCORE: ___ / 4 POINTS**

[A] $\cos 2$ [B] $\tan 2$ [C] $\sin 4$ [D] $\tan 4$

LETTER OF CORRECT ANSWER: D

MULTIPLE CHOICE: Consider the following statements: **SCORE: ___ / 4 POINTS**

[1] $\sin 3.2 < \sin 4.5$
[2] $\cos 3.2 < \cos 4.5$
[3] $\tan 3.2 < \tan 4.5$

Which of the above statements is/are true ?

[A] only [2] is true [B] only [3] is true [C] all are true [D] only [2] and [3] are true

LETTER OF CORRECT ANSWER: D

SUBMIT THIS SECTION BEFORE YOU PICK UP YOUR CALCULATOR

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CALCULATORS ALLOWED ON THIS SECTION

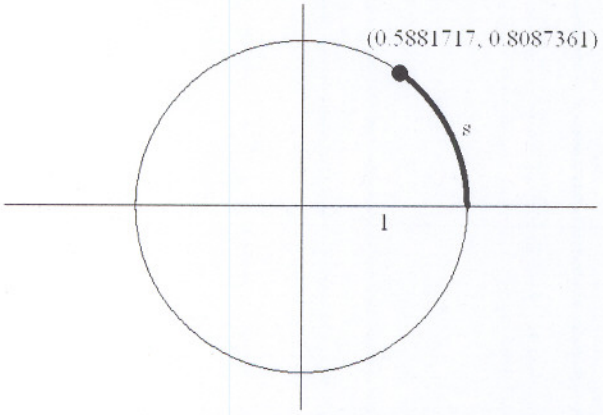
Find the value of s in $\left[0, \frac{\pi}{2}\right]$ such that $\sec s = 7$. Round to 3 decimal places. **SCORE: ___ / 6 POINTS**

SHOW HOW YOU GOT YOUR ANSWER.

$\cos s = \frac{1}{7}$

$s = \cos^{-1}\frac{1}{7} = 1.427$

Find the value of s in the diagram below. Round to 3 decimal places. **SCORE: ___ / 6 POINTS**
SHOW HOW YOU GOT YOUR ANSWER.

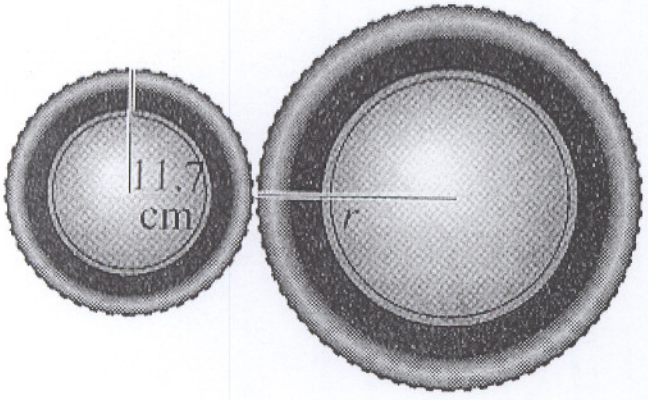


$\cos s = 0.5881717$

$s = \cos^{-1}(0.5881717)$

$= 0.942$

Find the radius of the larger wheel in the diagram below if it rotates 67° when the smaller wheel rotates 107°. **SCORE: ___ / 12 POINTS**
Round your answer to 1 decimal place. **SHOW HOW YOU GOT YOUR ANSWER.**



$s_1 = s_2$

$r_1\theta_1 = r_2\theta_2$

$(11.7\text{ cm})(107^\circ)\left(\frac{\pi}{180^\circ}\right) = r_2(67^\circ)\left(\frac{\pi}{180^\circ}\right)$

$r_2 = \frac{(11.7\text{ cm})(107^\circ)}{67^\circ}$

$= 18.7\text{ cm}$

THE RADIUS OF THE LARGER WHEEL IS 18.7 cm

Convert 2.59 radians to degrees (round to 3 decimal places). **SHOW HOW YOU GOT YOUR ANSWER.** **SCORE: ___ / 4 POINTS**

$$2.59^r \times \frac{180^\circ}{\pi r} = 148.396^\circ$$

The tires of a bicycle are 13 inches in radius. If the tires are turning at a rate of 250 revolutions per minute, how fast is the bicycle traveling in miles per hour ? Round your answer to 1 decimal place. **SHOW HOW YOU GOT YOUR ANSWER.** **SCORE: ___ / 12 POINTS**

$$v = r\omega$$

$$= (13\text{ in})\left(\frac{250\text{ rev}}{\text{min}}\right)\left(\frac{2\pi r}{\text{rev}}\right)\left(\frac{60\text{ min}}{\text{hr}}\right)\left(\frac{1\text{ ft}}{12\text{ in}}\right)\left(\frac{1\text{ mi}}{5280\text{ ft}}\right)$$

$$= 19.3\text{ mi/hr}$$

THE BICYCLE IS TRAVELING AT 19.3 MPH.

BONUS QUESTION

Find an equation of the form $y = a\sin(bx+c)+d$ or $y = a\cos(bx+c)+d$ for the graph below. **SHOW HOW YOU GOT YOUR ANSWER.** **SCORE: ___ / 14 POINTS**