Math 51 (9:30am – 10:20am)
Midterm 2
Thu May 14, 2009

SCORE: ___ / 140 POINTS

PINK + GREEN

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

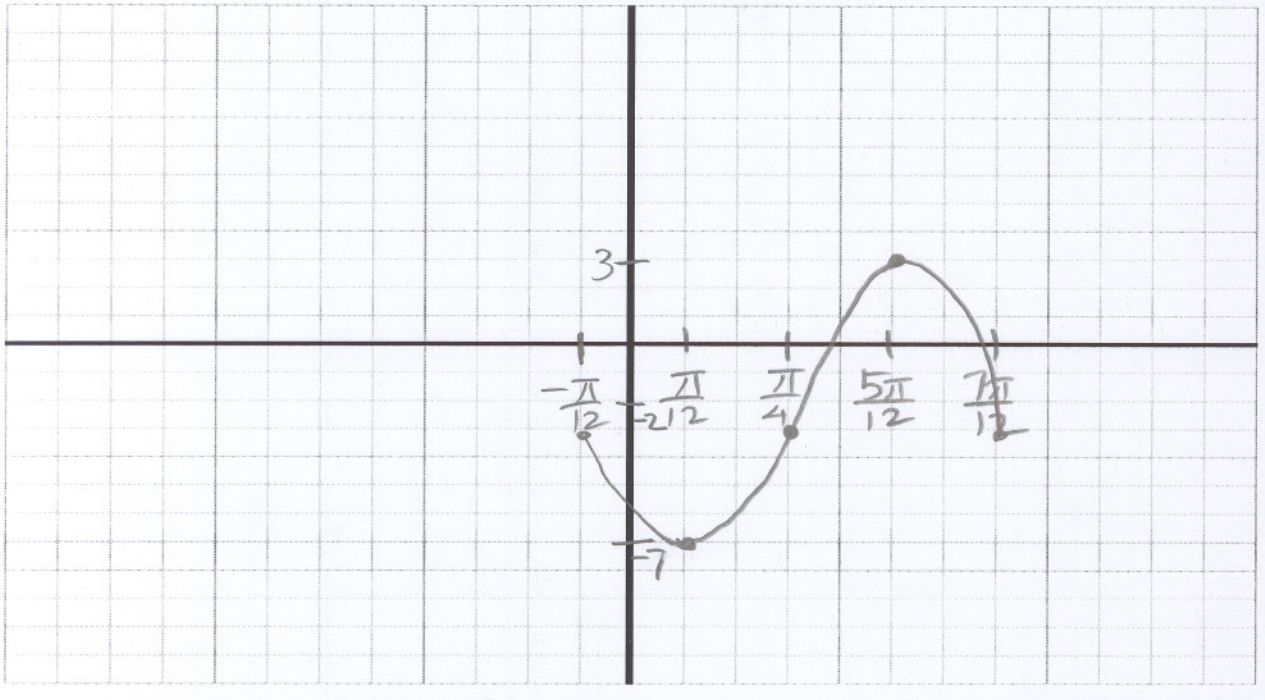
Fill in the circular function values. **SCORE: ___ / 12 POINTS**

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

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

$\tan\frac{17\pi}{6} = -\frac{\sqrt{3}}{3}$ $\cos\frac{4\pi}{3} = -\frac{1}{2}$ $\sin\frac{3\pi}{4} = \frac{\sqrt{2}}{2}$

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 $y = -2 + 5 = 3$
MIN $y = -2 - 5 = -7$

PHASE SHIFT = $\frac{-\frac{\pi}{4}}{3} = -\frac{\pi}{12}$

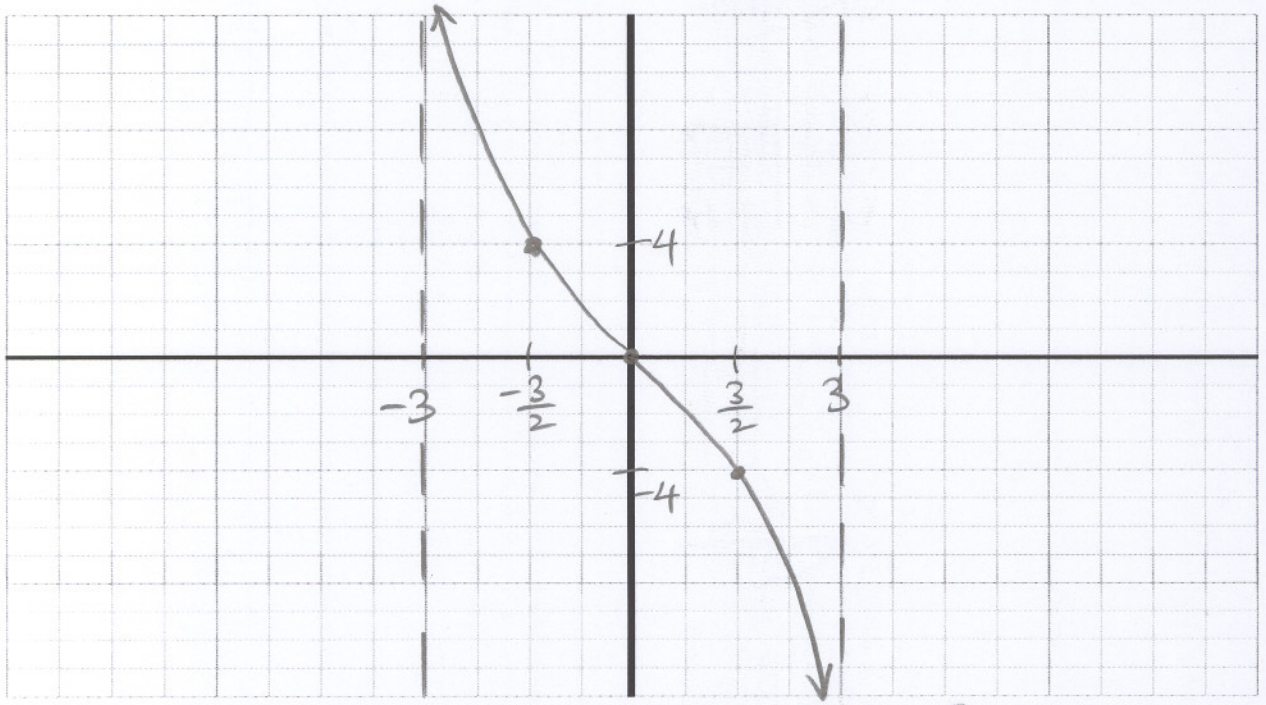
$-\frac{\pi}{12} + \frac{\pi}{6} = -\frac{\pi}{12} + \frac{2\pi}{12} = \frac{\pi}{12}$

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

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

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

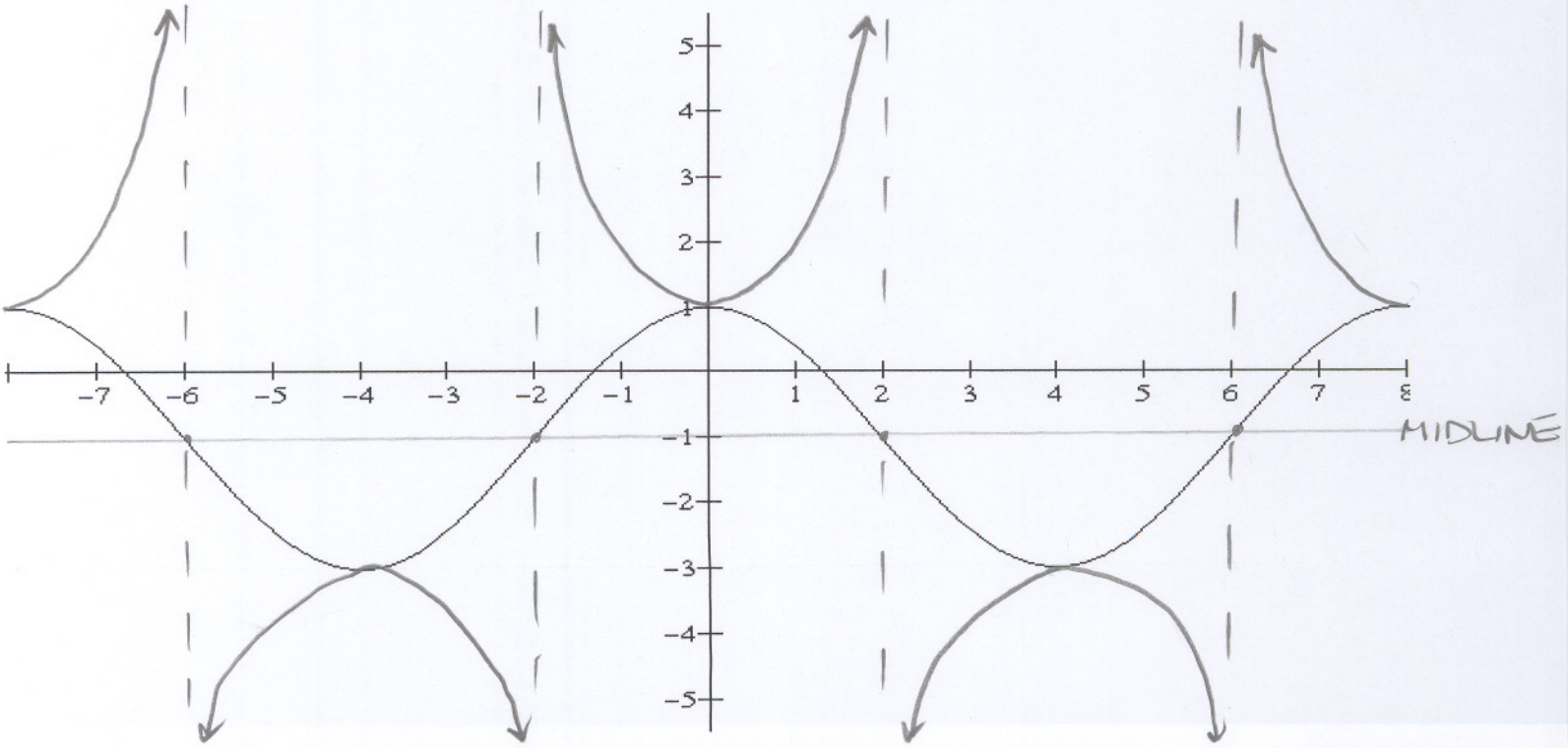
Graph **one period** of $y = -4\tan\frac{\pi x}{6}$. Label all relevant x- and y-values discussed in class. **SCORE: ___ / 16 POINTS**



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

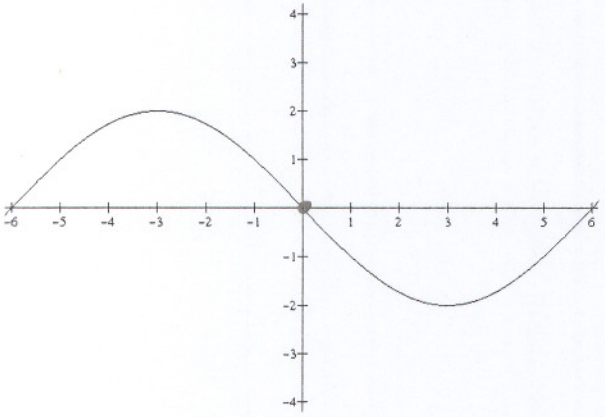
$a = -4$

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 $\left[\pi, \frac{3\pi}{2}\right]$ such that $\tan s = \sqrt{3}$. **SCORE: ___ / 6 POINTS**

$s = \pi + \frac{\pi}{3} = \frac{4\pi}{3}$

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

[A] $\cos 3$ [B] $\tan 3$ [C] $\cos 5$ [D] $\tan 5$

LETTER OF CORRECT ANSWER: C

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] none is true [B] only [1] is true [C] only [1] and [2] are true [D] only [1] and [3] are true

LETTER OF CORRECT ANSWER: B

SUBMIT THIS SECTION BEFORE YOU PICK UP YOUR CALCULATOR

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

GREEN + PINK

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CALCULATORS ALLOWED ON THIS SECTION

Find the value of s in $\left[0, \frac{\pi}{2}\right]$ such that $\sec s = 5$. Round to 3 decimal places. **SCORE: ___ / 6 POINTS**

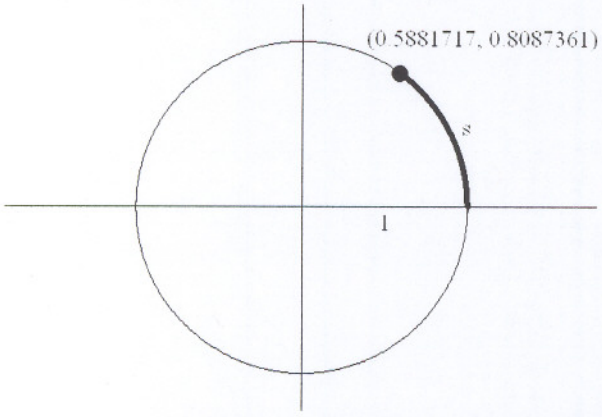
SHOW HOW YOU GOT YOUR ANSWER.

$\cos s = \frac{1}{5}$

$s = \cos^{-1}\frac{1}{5} = 1.369$

Find the value of s in the diagram below. Round to 3 decimal places. **SCORE: ___ / 6 POINTS**

SHOW HOW YOU GOT YOUR ANSWER.

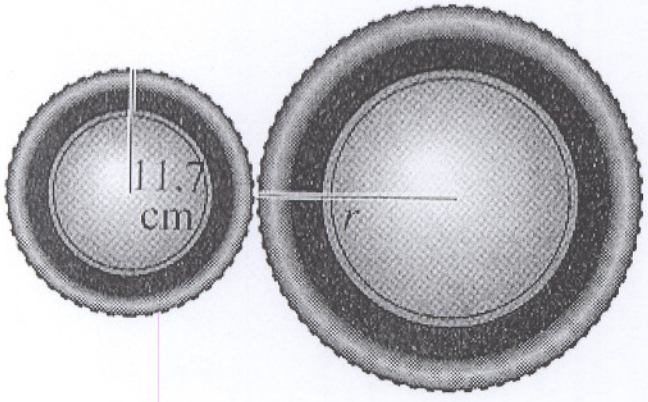


$\cos s = 0.5881717$

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

$= 0.942$

Find the radius of the larger wheel in the diagram below if it rotates 58° when the smaller wheel rotates 108°. **SCORE: ___ / 12 POINTS**
Round your answer to 1 decimal place. **SHOW HOW YOU GOT YOUR ANSWER.**



$s_1 = s_2$

$r_1\theta_1 = r_2\theta_2$

$(11.7\text{cm})(108^\circ)\left(\frac{\pi}{180^\circ}\right) = r_2(58^\circ)\left(\frac{\pi}{180^\circ}\right)$

$r_2 = \frac{(11.7\text{cm})(108^\circ)}{58^\circ}$

$= 21.8\text{cm}$

THE LARGER WHEEL HAS A RADIUS OF 21.8cm

Convert 3.86 radians to degrees (round to 3 decimal places). **SHOW HOW YOU GOT YOUR ANSWER.** **SCORE: ___ / 4 POINTS**

$3.86^r \times \frac{180^\circ}{\pi^r} = 221.162^\circ$

The tires of a bicycle are 14 inches in radius. If the tires are turning at a rate of 220 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**

$V = rw$

$= 14\text{in} \cdot \frac{220\,\text{rev}}{\text{min}} \cdot \frac{2\pi^r}{\text{rev}} \cdot \frac{60\,\text{min}}{\text{hr}} \cdot \frac{1\,\text{ft}}{12\,\text{in}} \cdot \frac{1\,\text{mi}}{5280\,\text{ft}}$

$= 18.3\ \text{mi/hr}$

THE BICYCLE IS TRAVELING 18.3 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. **SCORE: ___ / 14 POINTS**

SHOW HOW YOU GOT YOUR ANSWER.