Test 2A, Math 130.001

9:34

SSII, 2009

Name: Key

PID Number: _____

I pledge that I have neither given nor received any unauthorized assistance on this exam.

_____

(signature)

DIRECTIONS

1. Show all of your work. A correct answer with insufficient work will be counted wrong.
2. Clearly indicate your answer by putting a box around it.
3. Calculators are allowed on this exam, but NOT cell phones or laptops.
4. Give all answers in exact form, not decimal form (that is, put π instead of 3.1415, $\sqrt{2}$ instead of 1.414, etc) unless otherwise stated.
5. Total number of questions = 10. Total points = 100.
6. Make sure you sign the pledge and write your PID on both pages.

Test A

PID Number: Key

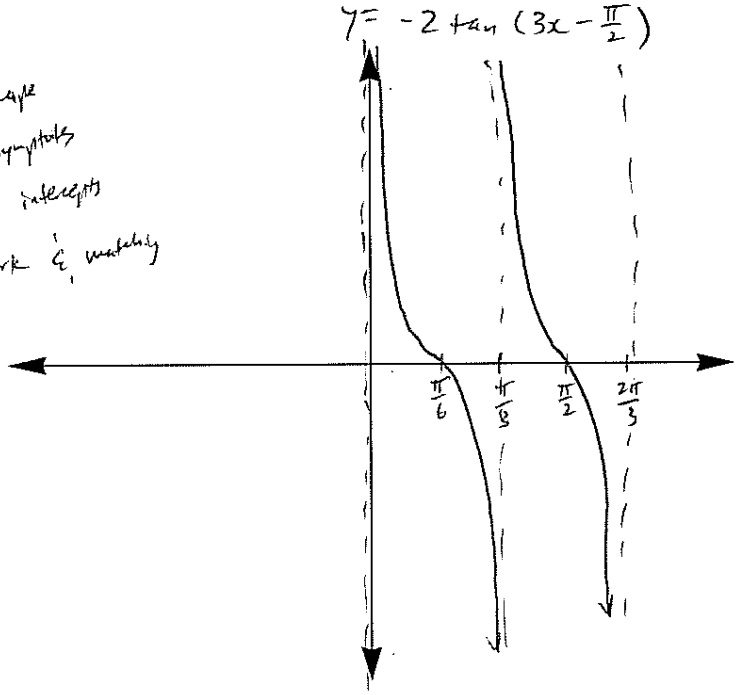
1. (10 points) Graph $y = 2\tan(-3x + \frac{\pi}{2})$

$y = -2\tan(3x - \frac{\pi}{2})$

$-\frac{\pi}{2} < 3x - \frac{\pi}{2} < \frac{\pi}{2}$

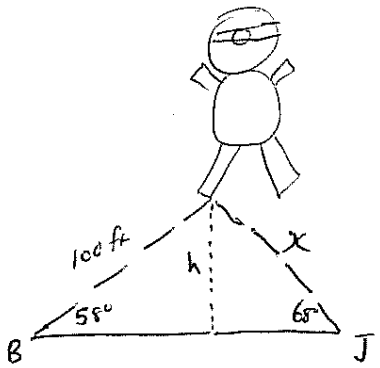
$0 < 3x < \pi$

$0 < x < \frac{\pi}{3}$



✓✓ shape
✓✓ asymptotes
✓✓ intercepts
4 work & modeling

2. (12 points) For a health-care rally, protesters are flying a giant inflatable doctor balloon. Bob and Jim are holding the doctor down with wires. Bob's wire has an angle of elevation of 58° and is 100 feet long. Jim's wire has an angle of elevation of 68°. Calculate how high the doctor is above the ground (h) and also how long Jim's wire is. Round your answers to the nearest tenth of a foot.



-6 for wrong diagram

$\sin 58° = \frac{h}{100 ft}$

$\sin 58° \cdot 100\ ft = h$

$84.8\ ft = h$

$\sin 68° = \frac{h}{x}$

$x = \frac{h}{\sin 68°}$

$x = 91.5\ ft$

0.01

3. (10 points) Find all θ in $[0, 4\pi)$ that satisfy $\sec\theta = -2.917$ (Round your answers off to the nearest ~~0.1~~ radian).

$\frac{1}{\cos\theta} = -2.917$ — 4 for incorrect angle in QIII

$\Rightarrow \cos\theta = \frac{1}{-2.917}$

$\theta = \cos^{-1}\left(\frac{1}{-2.917}\right)$

$\theta = 1.92 \leftarrow$ QII

also an answer in QIII, $2\pi - 1.92 = 4.36$

Then we also add 2π to each answer to get

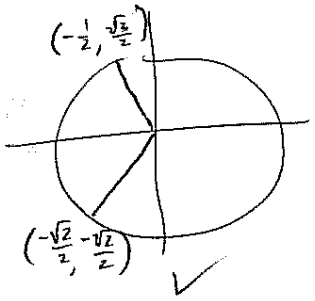
1.92, 4.36, 8.20, 10.65

4. (6 points) Find the exact value of $\sec\left(\frac{2\pi}{3}\right) + \sin\left(\frac{-3\pi}{4}\right)$ 2✓✓

$= \frac{1}{\cos\left(\frac{2\pi}{3}\right)} + \frac{-\sqrt{2}}{2}$

$= -2 \mp \frac{\sqrt{2}}{2}$

$= \boxed{\frac{-4 \mp \sqrt{2}}{2}}$



✓

5. (12 points) Verify the following identity:

$$\frac{\sec(-x)+\csc(-x)}{\tan(-x)+\cot(-x)} = \cos x - \sin x$$

$$\frac{\sec(-x)+\csc(-x)}{\tan(-x)+\cot(-x)} = \frac{\sec x - \csc(x)}{-\tan x - \cot x} \quad \checkmark\checkmark$$

$$= \frac{\frac{1}{\cos x} - \frac{1}{\sin x}}{\frac{-\sin x}{\cos x} - \frac{\cos x}{\sin x}} \cdot \frac{(\sin x \cos x)}{(\sin x \cos x)} \quad \checkmark\checkmark\checkmark$$

$$= \frac{\sin x - \cos x}{-\sin^2 x - \cos^2 x} \quad \checkmark\checkmark$$

$$= \frac{\sin x - \cos x}{-(\sin^2 x + \cos^2 x)} \quad \checkmark\checkmark$$

$$= \frac{\sin x - \cos x}{-1} \quad \checkmark$$

$$= \cos x - \sin x \quad \checkmark$$

12 minutes.

6. (12 points) Write an equation for the following graph. Your answer can either be of the form $y = a\sin(bx+c)$ or $y = a\cos(bx+c)$.

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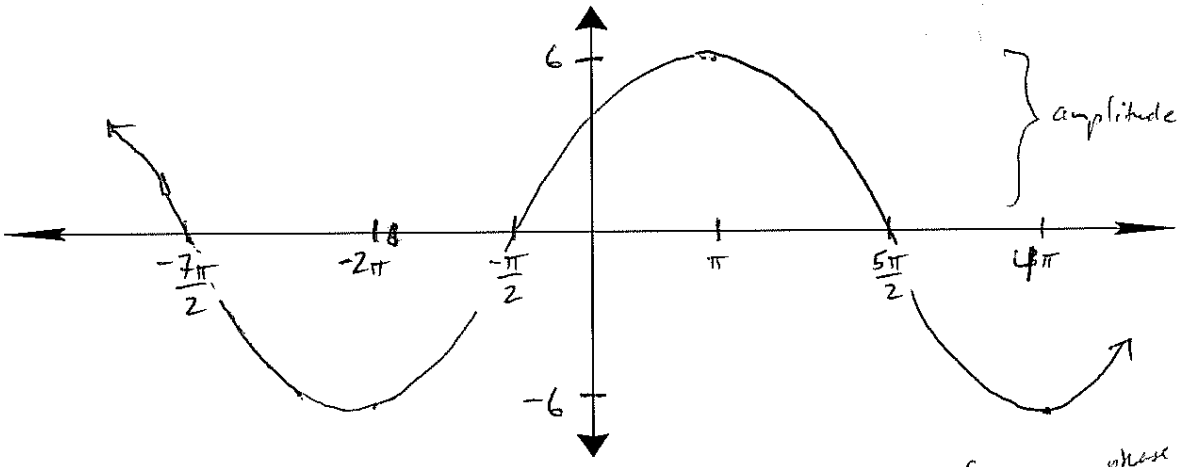
= 10



amplitude = $a = 6$

Answer: $y = \dfrac{6\sin\left(\frac{1}{3}x + \frac{\pi}{6}\right)}{6\cos\left(\frac{1}{3}x - \frac{\pi}{3}\right)}$

for sin, phase shift is $\frac{-\pi}{2}$ and period is 6π.

$6\pi = \frac{2\pi}{b} \Rightarrow b = \frac{1}{3}$

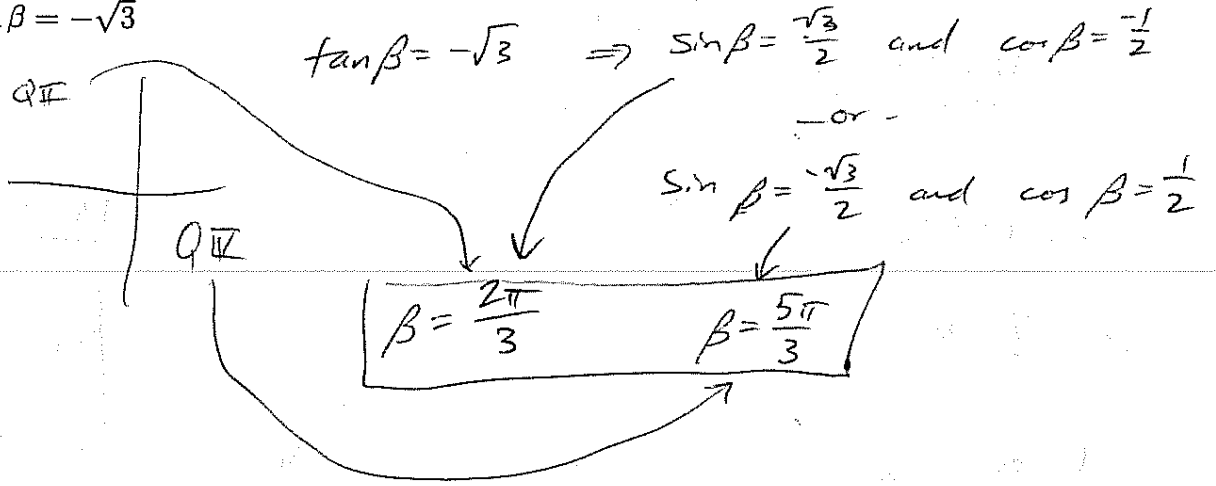
$P.S. = \frac{-\pi}{2} = \frac{-c}{b}$

$\Rightarrow \frac{6\pi}{3} = 2c$

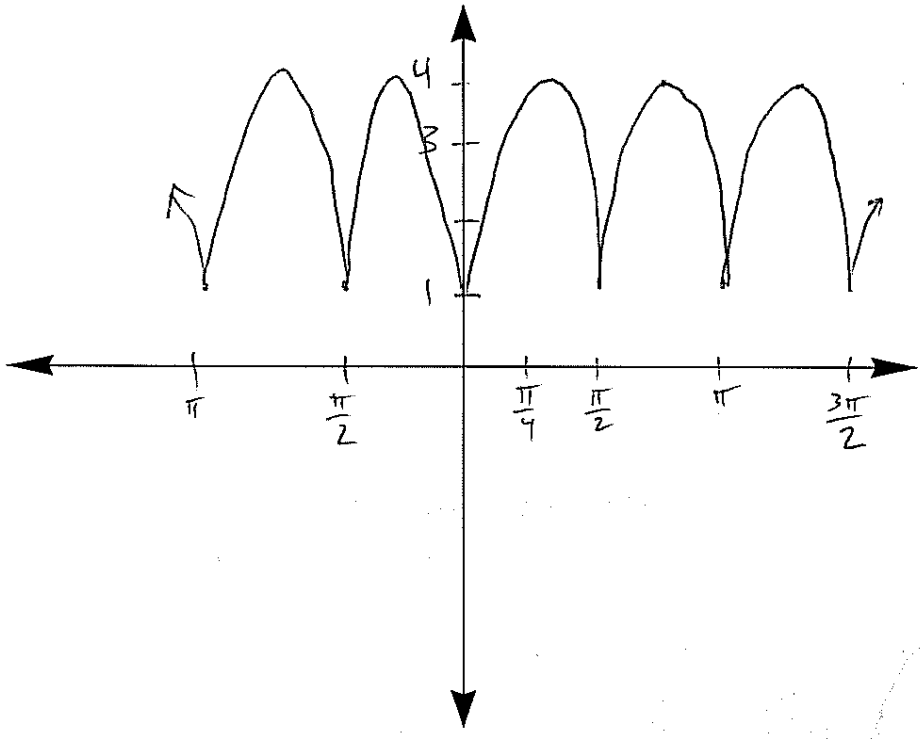
$c = \frac{2\pi}{3} \cdot \frac{1}{2}$

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

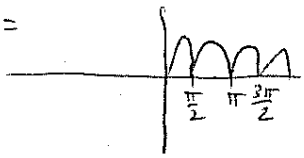
7. (8 points) Find the exact values of all β in the interval $[0, 2\pi)$ that satisfy the equation $\tan\beta = -\sqrt{3}$



8. (10 points) Graph $y = 3|\sin(2x)| + 1$



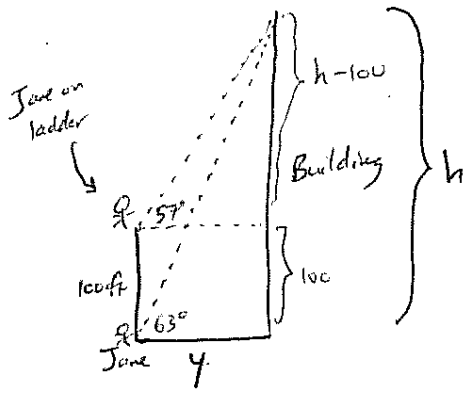
$|\sin(2x)| =$



9. (12 points) Jane is standing y feet from a tall building with a 100 foot tall ladder standing next to her. The angle of elevation from Jane to the top of the building is 63°. When Jane climbs to the top of the ladder, the angle of elevation from Jane to the top of the building is now 57°. Calculate the height of the building to the nearest foot.

$\tan 63° = \frac{h}{y}$ ✓✓✓ $\tan 57° = \frac{h-100}{y}$ ✓✓✓

Diagram



$y = \frac{h}{\tan 63°}$ $y = \frac{h-100}{\tan 57°}$ ✓

✓ $\frac{h-100}{1.5399} = \frac{h}{1.9626}$

✓ $1.9626(h-100) = h(1.5399)$

✓ $1.9626h - h\cdot(1.5399) = 196.2610$

$h(1.9626 - 1.5399) = 196.261$ ✓

$h = 464.29$

$h = 464$ ft

10. (8 points)

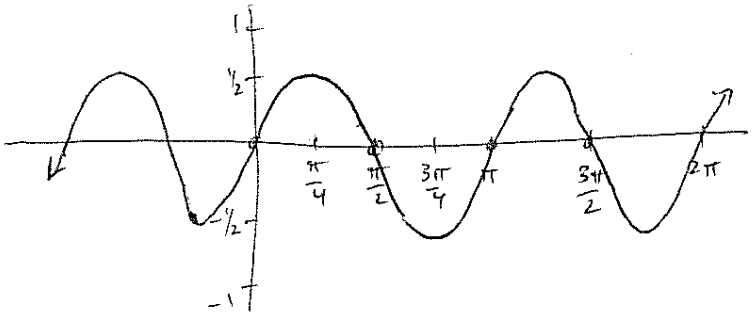
(a) As $x \to \left(\frac{-\pi}{4}\right)^-$, $\tan x \to$ -1

(a) As $x \to \left(\frac{\pi}{2}\right)^-$, $\tan x \to$ ∞

(a) As $x \to \pi^-$, $\sin x \to$ 0

(a) As $x \to \pi^+$, $\csc x \to$ $-\infty$

Extra Credit(2 points): ~~For an angle θ in Quadrant II,~~ write $\cot\theta$ in terms of $\sin\theta$.



$y=0$ every $\frac{\pi}{2}$. Positive in QI and QIII, negative elsewhere.

Max of $\frac{1}{2} = \frac{\sqrt{2}}{2}\cdot\frac{\sqrt{2}}{2}$, occurs at $\frac{\pi}{4}$.