I: 5m, II: 30m

Exam #1: Part I, MAT 182 [pages 1-2]

Anthony Tanbakuchi, Spring 2007

Instructions: **Calculators permitted on this section only**!

Circle all answers. No books or notes. Sit in every other seat. Simplify all final answers. Do your own work. Show steps where appropriate (or I can't give partial credit). Unless indicated, angles are in radians. Answers should be given in radians for angles unless requested in degrees. You have 1 hour and 10 minutes for this exam. If you run out of space then write "see back" on the problem and write the problem number on the back and continue. One sheet of scratch paper is included on the last page in part II. If something is unclear quietly come up and ask me.

When you finish Part I turn it in and get Part II. Once you turn in Part I you cannot make changes to it.

Pace yourself, use no more than 15 minutes for Part I. Part II is longer and will take more time.

■ Calculator section

1. Use a calculator to approximate the value of the following expressions. Round your answers to **two decimal places**.

[1 pts] (a) $\sin(8.4°) \approx 0.15$

[1 pts] (b) $\cot(\frac{\pi}{16}) = \frac{1}{\tan(\pi/16)}$

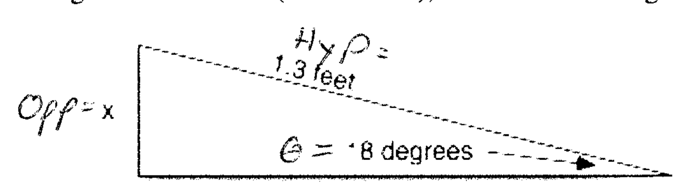
≈ 5.03

[2 pts] (c) $\sin(\theta)=0.14$, find θ in degrees ($0 \le \theta \le 90°$)

$\theta = \sin^{-1}(0.14)$

$\theta \approx 8.05°$

2. [2 pts] For the triangle shown below (not to scale), determine the length x.



$\sin\theta = \frac{Opp}{Hyp}$

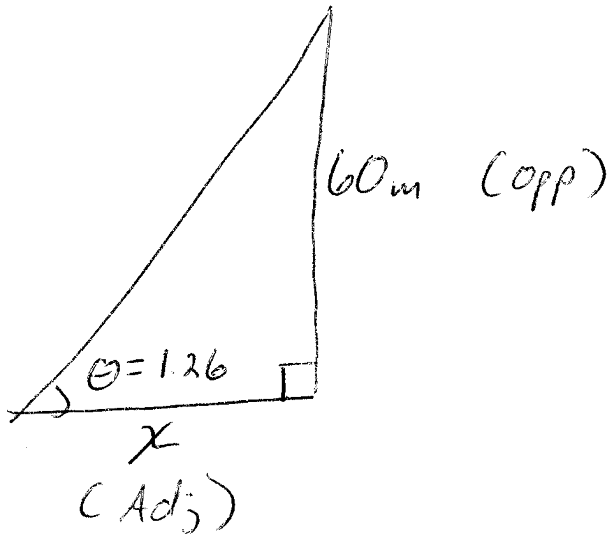
$\sin 18° = \frac{x}{1.3ft}$

$x = 1.3ft \cdot \sin 18°$

$x \approx 0.40 ft$

3. I have a laser pointer and I measure the height of the U of A clock tower to be 60m. To determine the height I aimed a laser so it made a red dot at the top of the tower. I measured that the laser was pointed up with an angle of elevation of 1.26 radians. What distance was I standing from the base of the tower?

[2 pts] (a) Make a simple diagram of the problem and label it with the key information provided.



[2 pts] (b) Solve for distance I was standing from the tower.

$$\tan\theta = \frac{opp}{Adj}$$

$$\tan 1.26 = \frac{60m}{x}$$

$$x = \frac{60m}{\tan 1.26}$$

$$x \approx 19.27\ m$$

Exam #1: Part II, MAT 182 [pages 3-8]

Anthony Tanbakuchi,

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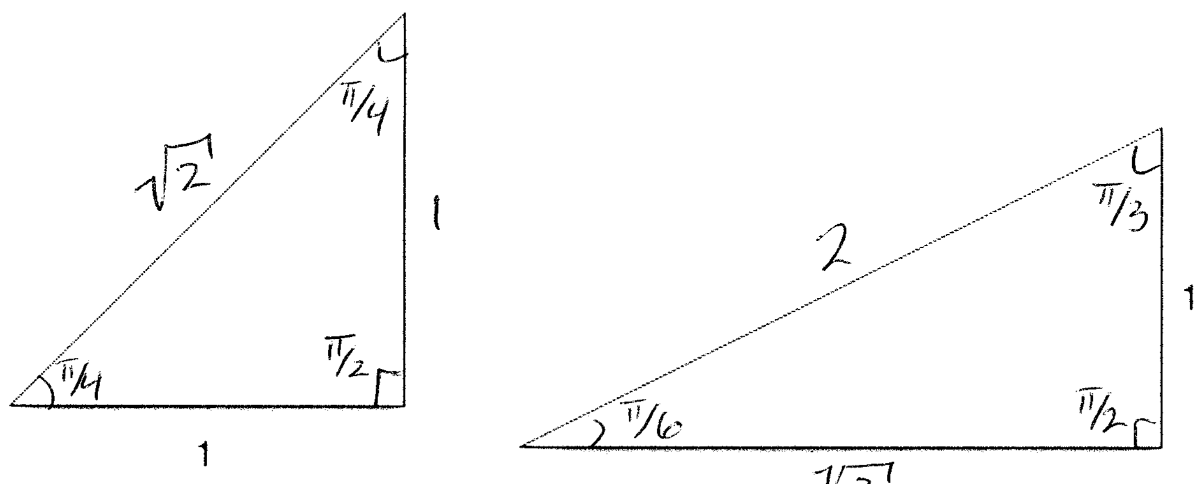
1. For the two triangles below, **label the angles in radians** and **label the length of the sides missing sides**. [The length of one side is already labeled.]

[1 pts] (a) 45-45-90° triangle (left):

[1 pts] (b) 30-60-90° triangle (right):



2. For the following trigonometric function, write the definition in relation to a triangle in terms of: ***θ*, Hyp, Opp, Adj**. (Don't forget *θ*)

[1 pts] (a) sine

$$\sin\theta = \frac{Opp}{Hyp}$$

3. For the following trigonometric function, write the definition in relation to a circle in terms of: ***θ*, r, x, y**. (Don't forget *θ*)

[1 pts] (a) cosecant:

$$\csc\theta = \frac{1}{\sin\theta} = \frac{1}{\left(\frac{y}{r}\right)} \quad \therefore \quad \csc\theta = \frac{r}{y}$$

4. [2 pts] Convert 36° to radians.

$$360° = 2\pi \quad \therefore \left(\frac{2\pi}{360°}\right) = 1$$

$$36°\left(\frac{2\pi}{360°}\right) = \frac{2\pi}{10}$$

$$= \frac{\pi}{5}$$

5. Identities:

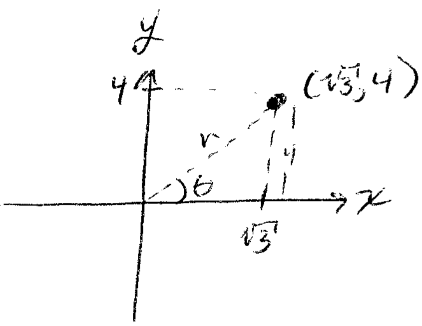
[1 pts] (a) Write the pythagorean identity that involves sine.

$$\sin^2\theta + \cos^2\theta = \underline{1}$$

[1 pts] (b) Write the reciprocal identity for cot θ:

$$\cot\theta = \frac{1}{\tan\theta}$$

6. [4 pts] Find the value of cos θ for an angle θ who's terminal side passes through $(\sqrt{3}, 4)$.



$$\cos\theta = \frac{x}{r} \leftarrow \text{need to find } r$$

$$\cos\theta = \frac{\sqrt{3}}{\sqrt{19}}$$

- rationalize denominator

$$r^2 = x^2 + y^2$$

$$r = \sqrt{x^2 + y^2}$$

$$r = \sqrt{3 + 16}$$

$$r = \sqrt{19}$$

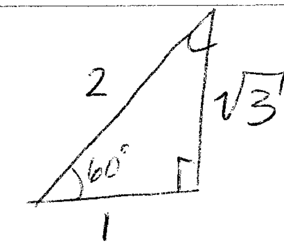
$$\cos\theta = \frac{\sqrt{3}}{\sqrt{19}}\left(\frac{\sqrt{19}}{\sqrt{19}}\right)$$

$$= \frac{\sqrt{3}\sqrt{19}}{19}$$

$$= \frac{\sqrt{3 \cdot 19}}{19}$$

$$\cos\theta = \frac{\sqrt{57}}{19}$$

7. Evaluate each function (give exact answers).



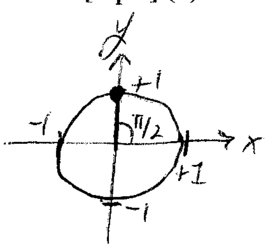
[2 pts] (a) csc 60° $= \frac{1}{\sin 60^\circ}$

$= \frac{Hyp}{Opp}$

$= \frac{2}{\sqrt{3}}$

$= \frac{2\sqrt{3}}{3}$

[2 pts] (b) $\tan(\frac{\pi}{2})$

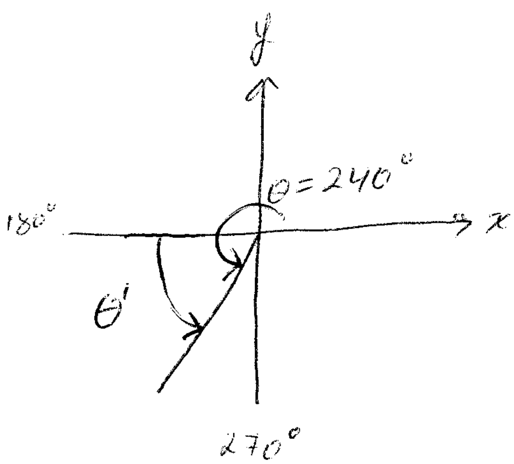


$\tan\theta = \frac{y}{x}$

$\tan\theta = \frac{1}{0}$

$\tan\theta =$ undefined

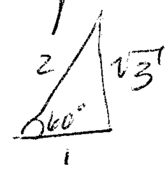
[2 pts] (c) cos(240°) $\theta > 90^\circ$, use reduction principle.



• For ref angle

$\cos 60^\circ = \frac{Adj}{Hyp}$

$= \frac{1}{2}$



• θ is in QIII ∴ cos 240° is negative

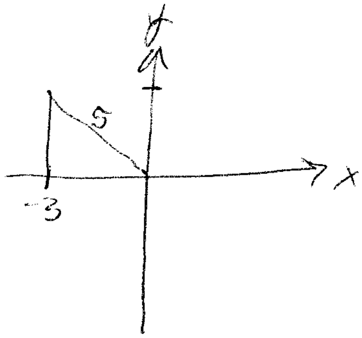
∴ $\cos 240^\circ = -\frac{1}{2}$

$\theta - \theta' = 180^\circ$

$\theta' = 240^\circ - 180^\circ$

$\theta' = 60^\circ$

8. [4 pts] If $\cos\theta = -\frac{3}{5}$ and $\tan\theta < 0$, find $\sin\theta$. (This was a quiz question)



- $\cos\theta = \frac{x}{r} = \frac{-3}{5}$

  $\therefore$ $\underline{x = -3}$, $\underline{r = 5}$

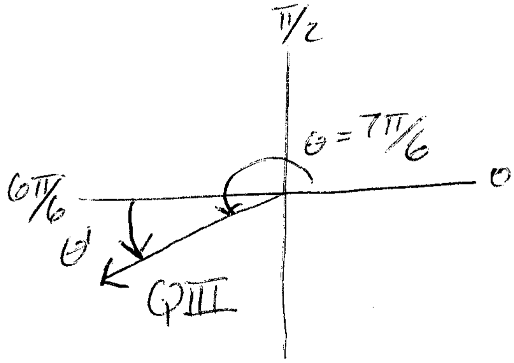
- Since $\cos\theta$ is neg ; $\tan\theta$ neg

  θ is in QII $\therefore$ $\underline{\sin\theta \text{ is positive.}}$

$\sin\theta = \frac{y}{r}$ • $x^2 + y^2 = r^2$, solve for $y = 4$

$\sin\theta = \frac{4}{5}$

9. [2 pts] Write $\sin(\frac{7\pi}{6})$as a function of an acute angle.



- Sine is $\underline{\text{negative}}$ in QIII

Thus,

$\sin(7\pi/6) = -\sin(\pi/6)$

$\pi = 7\pi/6 - \theta'$

$\theta' = \pi/6$

10. P(x, y) is a point on the terminal side of an angle ϕ in standard position. P(x, y) is at a distance r from the origin.

(a) [2 pts] What is the y coordinate of P in terms of ϕ and r?

$\sin \theta = \frac{y}{r}$

solving for y

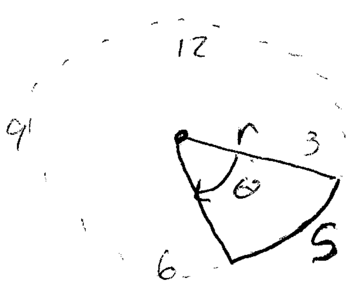
$y = r \sin \theta$

(b) [2 pts] If I know the coordinates x & y of the point P, how would I find the distance of P from the origin? Write an expression for the distance r in terms of x & y.

$r^2 = x^2 + y^2$

$r = \sqrt{x^2 + y^2}$ (r is a distance ∴ positive)

11. [2 pts] A second hand sweeps out an arc of length 10 inches over a time interval t. During the same time interval t, the second hand subtends a central angle of $\frac{\pi}{12}$. What is the length of the second hand?



$S = \theta \cdot r$

Length of second hand is r

$\theta = \pi/12$, $S = 10 in$

$r = \frac{S}{\theta}$

$= \frac{10 in}{(\pi/12)}$

$= \frac{10 in \cdot 12}{\pi}$

$r = \frac{120}{\pi} in$

[Scratch Paper]