

Name: _____ PUID: _____

ClassTime/Day	Section	Instructor	Room
MWF 8:30 am	0021	Delworth, Tim	SMITH 108
Online	0004	Delworth, Tim	

Instructions:

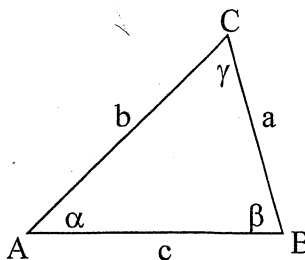
- ◆ You must use a #2 pencil on the answer sheet.
- ◆ On the answer sheet, fill in: (This has to be correct to find your score online.)
 - a) Your last name, first name and middle initial and blacken the appropriate spaces.
 - b) Your section number and blacken the appropriate spaces.
 - c) Your 10-digit student identification number and blacken the appropriate spaces.
 - d) Fill in the test/quiz number with **01** and blacken in **01**.
 - e) Sign your name at the bottom of the answer sheet.
- ◆ Make sure that the cover of this exam matches the color of your answer sheet. If you are color blind, ask the person sitting next to you for assistance.
- ◆ There are 15 questions. On the answer sheet, blacken your choice of the correct answer in the spaces provided for questions 1-15. Do all of your work on the question sheets. Turn in the answer sheet when you leave and keep the question sheets. Only the answer sheet will be graded. Do not walk out of the Hall without turning in your answer sheet!
- ◆ All questions are worth the same. Please answer every question. No points will be deducted for wrong answers, so why would you not answer every question?
- ◆ A TI-30 XA, one-line calculator may be used. No other calculator is allowed.
- ◆ Besides your calculator, all other electronics devices must be turned off and out of sight.
- ◆ No books or papers are allowed. You cannot bring in a unit circle or a formula sheet.
- ◆ The exam is self-explanatory. Do not ask questions about any of the exam problems unless you feel there is a typo.
- ◆ Exam answers will be posted on the MA 15400 course web page about two hours after the exam. Exam scores will be posted in the grade book in WebAssign about two day after the exam. Please check your exam score online before the next exam. The posted score is the official score. If you feel there is an error, contact Tim Delworth, delworth@math.purdue.edu

PYTHAGOREAN IDENTITIES:

$$\sin^2 \theta + \cos^2 \theta = 1$$

$$1 + \tan^2 \theta = \sec^2 \theta$$

$$1 + \cot^2 \theta = \csc^2 \theta$$



1. Find the angle that is supplementary to $75^{\circ}18'12''$

A. $14^{\circ}41'48''$

B. $104^{\circ}42'49''$

C. $14^{\circ}42'49''$

D. $104^{\circ}41'48''$

E. None of the above

$$\begin{array}{r} 179^{\circ}59'51'' \\ \cancel{180^{\circ}60'60''} \\ - 75^{\circ}18'12'' \\ \hline 104^{\circ}41'48'' \end{array}$$

2. Express $\theta = 41^{\circ}25'43''$ as a decimal to the nearest ten-thousandth of a degree.

A. 41.3415°

B. 41.4286°

C. 41.2543°

D. 41.5522°

E. None of the above

$$\frac{\frac{43}{60} + 25}{60} = 0.4286^{\circ}$$

or

$$\frac{43}{3600} + \frac{25}{60} = 0.4286^{\circ}$$

$$41.4286^{\circ}$$

3. If a circular arc of the given length $s = 4$ m subtends the central angle $\theta = 70^{\circ}$ on a circle, find the radius of the circle. Round your answer to the nearest hundredth.

A. 6.93 m

B. 5.76 m

C. 3.27 m

D. 4.51 m

E. None of the above

$$s = r\theta$$

$$4 = r \left(\frac{70\pi}{180} \right)$$

$$4 = r(1.2217)$$

$$\frac{4}{1.2217} = r = 3.2740$$

4. Find $\cot \theta$ for the given triangle?

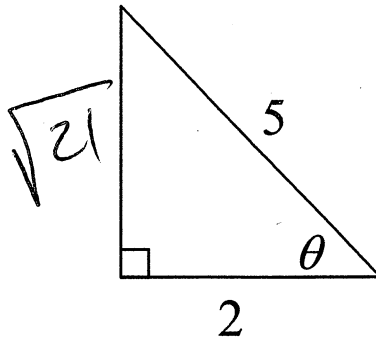
A. $\cot \theta = \frac{2}{\sqrt{21}}$

B. $\cot \theta = \frac{5}{\sqrt{21}}$

C. $\cot \theta = \frac{\sqrt{21}}{5}$

D. $\cot \theta = \frac{2}{5}$

E. None of the above



$$5^2 = b^2 + 2^2$$

$$25 - 4 = b^2$$

$$b = \sqrt{21}$$

$$\tan \theta = \frac{\sqrt{21}}{2}$$

$$\cot \theta = \frac{2}{\sqrt{21}}$$

5. Stonehenge in Salisbury Plains, England, was constructed using solid stone blocks weighing over 99,000 pounds each. Lifting a single stone required 550 people, who pulled the stone up a ramp inclined at an angle of 8° . To the nearest foot, approximate the distance that a stone **moved along the ramp** in order to raise it to a height of 59 feet off the ground.

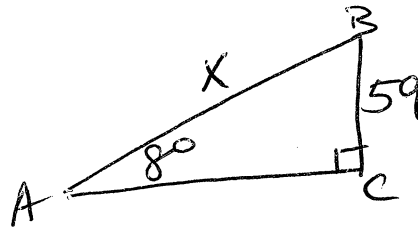
A. 521 feet

B. 424 feet

C. 343 feet

D. 397 feet

E. None of the above



$$\sin 8^\circ = \frac{59}{X}$$

$$X = \frac{59}{\sin 8^\circ}$$

$$X = 423.9$$

6. Which of the following is equivalent to $\cos^2 \theta (\sec^2 \theta - 1)$?

A. $\cos^2 \theta$

B. $1 + \tan^2 \theta$

C. $\csc \theta - \sin \theta$

D. $\sin^2 \theta$

E. $1 + \cot^2 \theta$

$$\sec^2 \theta - 1 = \tan^2 \theta \left(\frac{\cos^2 \theta}{1} \right) \left(\frac{1}{\cos^2 \theta} - 1 \right)$$

$$\cos^2 \theta (\tan^2 \theta)$$

$$\left(\frac{\cos^2 \theta}{1} \right) \left(\frac{\sin^2 \theta}{\cos^2 \theta} \right)$$

$$1 - \cos^2 \theta$$

$$\sin^2 \theta$$

$\sin^2 \theta$

Two good ways

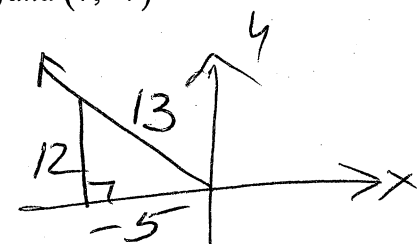
7. Find the exact value of $\cos \theta$ if θ is in standard position and the terminal side of θ is in quadrant II and parallel to the line through the points $A(2,5)$ and $(7,-7)$

- A. $\cos \theta = \frac{-5}{13}$
- B. $\cos \theta = \frac{12}{13}$
- C. $\cos \theta = \frac{-5}{12}$
- D. $\cos \theta = \frac{5}{13}$
- E. None of the above

$$m = \frac{5 - (-7)}{2 - 7} = \frac{12}{-5}$$

$$\tan \theta = -\frac{12}{5}$$

$$12^2 + 5^2 = 13^2$$

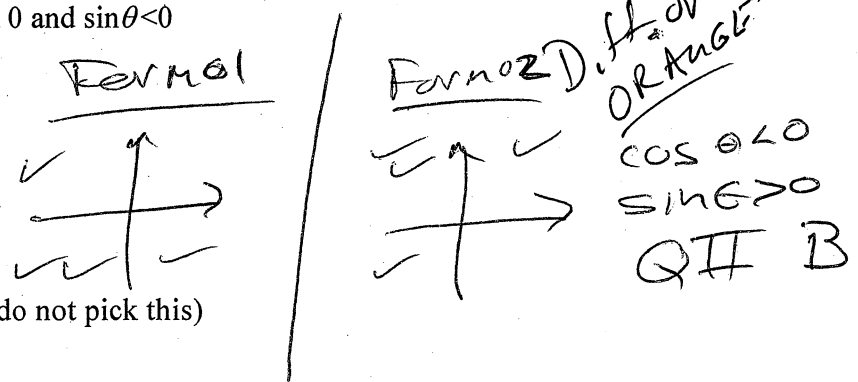


$$\cos \theta = \frac{-5}{13}$$

8. Find the quadrant containing θ if the given conditions are true.

$\cos \theta < 0$ and $\sin \theta < 0$

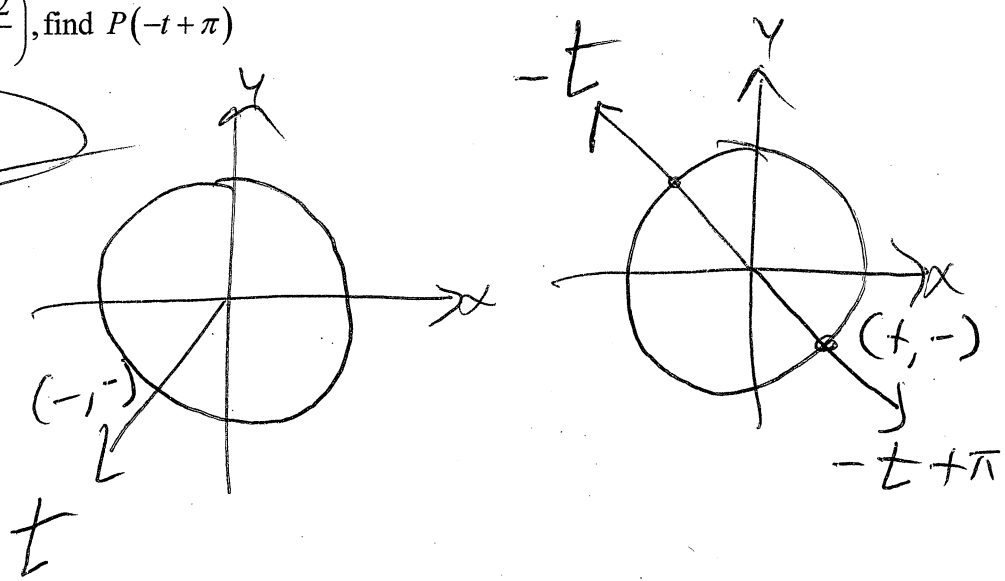
- A. QI
- B. QII
- C. QIII
- D. QIV
- E. QV (please do not pick this)



9. Let $P(t)$ be the point on the unit circle U that corresponds to t .

If $P(t) = \left(\frac{-5}{13}, \frac{-12}{13}\right)$, find $P(-t + \pi)$

- A. $\left(\frac{5}{13}, \frac{-12}{13}\right)$
- B. $\left(\frac{-5}{13}, \frac{-12}{13}\right)$
- C. $\left(\frac{-5}{13}, \frac{12}{13}\right)$
- D. $\left(\frac{5}{13}, \frac{12}{13}\right)$



10. Complete the statement: As $x \rightarrow \frac{\pi}{2}^-$, $\tan(x) \rightarrow \underline{+\infty}$

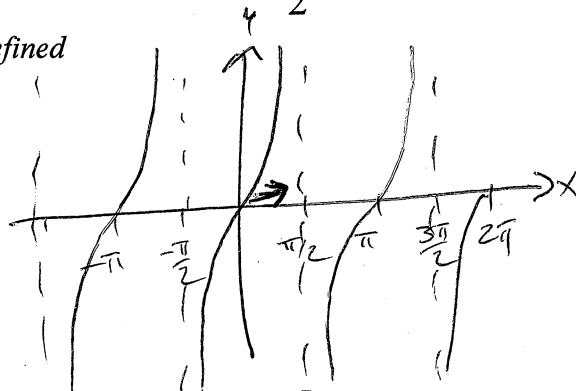
A. Undefined

B. 0

C. $-\infty$

D. 1

E. ∞



11. Find the reference angle θ_r if $\theta = \frac{5\pi}{3}$

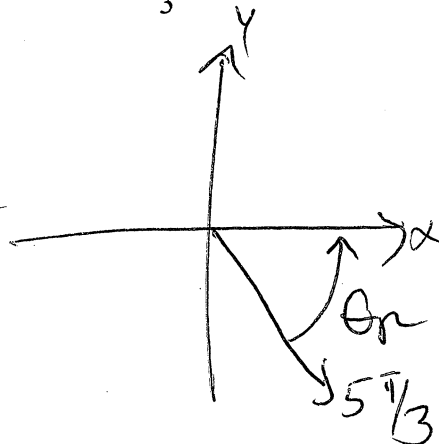
A. $\theta_r = \frac{\pi}{6}$

B. $\theta_r = \frac{\pi}{3}$

C. $\theta_r = \frac{2\pi}{3}$

D. $\theta_r = \frac{-\pi}{6}$

E. None of the above



$$\begin{aligned} \theta_r &= 2\pi - \frac{5\pi}{3} \\ &= \frac{6\pi}{3} - \frac{5\pi}{3} \\ &= \frac{\pi}{3} \end{aligned}$$

12. Find the Period and Phase Shift for the equation $y = 3\sin\left(4x - \frac{\pi}{7}\right)$ $a=3, b=4, c=-\frac{\pi}{7}$

A. Period = π , Phase Shift = $\frac{\pi}{14}$

B. Period = $\frac{\pi}{2}$, Phase Shift = $-\frac{\pi}{14}$

C. Period = π , Phase Shift = $-\frac{\pi}{28}$

D. Period = $\frac{\pi}{2}$, Phase Shift = $\frac{\pi}{28}$

E. None of the above.

$$\text{Per} = \frac{2\pi}{|b|}$$

$$\text{Per} = \frac{2\pi}{4}$$

$$\text{Per} = \frac{\pi}{2}$$

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

$$\text{P.S.} = -\frac{-\pi/7}{4}$$

$$\text{P.S.} = \frac{\pi}{7} \cdot \frac{1}{4}$$

$$\text{P.S.} = \frac{\pi}{28}$$

13. Find the y-intercept for $y = 3 \sin\left(\frac{\pi}{6}x + \frac{\pi}{3}\right)$.

A. (0,0)

B. $(0, 3\sqrt{2})$

C. $(0, \frac{3\sqrt{3}}{2})$

D. (0,-3)

E. $(0, \frac{3}{2})$

let $x=0$

$$y = 3 \sin\left(0 + \frac{\pi}{3}\right)$$

$$y = 3\left(\frac{\sqrt{3}}{2}\right) = \frac{3\sqrt{3}}{2}$$

14. Approximate, to the nearest 0.1° , all angles θ in the interval $[0^\circ, 360^\circ)$ that satisfy equation $\csc\theta = -8.1234$.

A. $\theta = 187.1^\circ, 352.9^\circ$

B. $\theta = 172.9^\circ, 352.9^\circ$

C. $\theta = 7.1^\circ, 172.9^\circ$

D. $\theta = 7.1^\circ, 187.1^\circ$

E. None of the above

$\frac{1}{\csc\theta} = \frac{1}{-8.1234}$

$\sin\theta = -0.1231$

$\theta = \sin^{-1}(-0.1231)$

$\theta = -7.07^\circ$

$\theta_R = 7.1^\circ$

$\theta_1 = 180^\circ + 7.1^\circ = 187.1^\circ$

$\theta_2 = 360^\circ - 7.1^\circ = 352.9^\circ$

15. Approximate, to the nearest 0.0001 (radians), all angles θ in the interval $[0, 2\pi)$ that satisfy equation $\cos\theta = 0.6842$

A. $\theta = 0.9542, 5.3290$

B. $\theta = 2.3243, 3.9589$

C. $\theta = 2.1874, 4.0958$

D. $\theta = 0.8173, 5.4659$

E. None of the above

$\theta = \cos^{-1}(0.6842)$

$\theta_1 = 0.8173$

$\theta_R = 0.8173$

$\theta_2 = 2\pi - 0.8173$

$\theta_2 = 5.4659$