MA 15400 Exam 2 Spring 2015

Form 01

Name: Solutions PUID

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

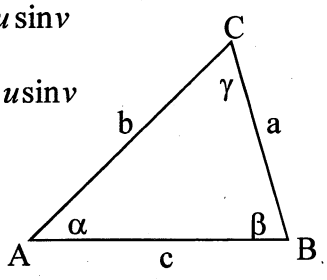
Instructions:

- 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 from a link in Blackboard about two hours after the exam. Exam scores will be posted in the Blackboard grade book about two days 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@purdue.edu.

$\sin(u+v)=\sin u\cos v+\cos u\sin v$ $\qquad$ $\sin(u-v)=\sin u\cos v-\cos u\sin v$

$\cos(u+v)=\cos u\cos v-\sin u\sin v$ $\qquad$ $\cos(u-v)=\cos u\cos v+\sin u\sin v$

$\tan(u+v)=\dfrac{\tan u+\tan v}{1-\tan u\tan v}$ $\qquad$ $\tan(u-v)=\dfrac{\tan u-\tan v}{1+\tan u\tan v}$



$\sin(2u)=2\sin u\cos u$ $\qquad$ $\cos(2u)=\cos^2 u-\sin^2 u$ $\qquad$ $\tan(2u)=\dfrac{2\tan u}{1-\tan^2 u}$

$\sin^2\theta+\cos^2\theta=1$ $\qquad$ $1+\tan^2\theta=\sec^2\theta$ $\qquad$ $1+\cot^2\theta=\csc^2\theta$

1. Express as a trigonometric function of one angle: $\cos 46° \cos 13° - \sin 46° \sin 13°$

A. $\sin(33°)$

B. $\cos(33°)$

C. $\sin(59°)$

D. $\cos(59°)$

$\cos u \cos v - \sin u \sin v = \cos(u+v)$

$= \cos(46° + 13°)$

$= \cos(59°)$

2. Given ΔABC with $\gamma = 90°, \alpha = 60°$, and $b = 18$, find the **exact** value of side a.

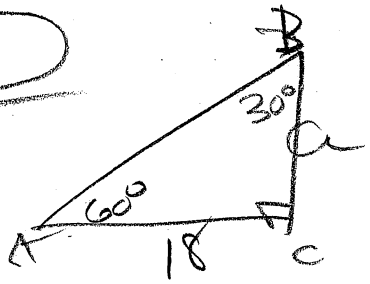
A. $18\sqrt{3}$

B. 36

C. $6\sqrt{3}$

D. 18

E. 9



$\tan 30° = \frac{18}{a}$

$\frac{1}{\sqrt{3}} = \frac{18}{a}$

$a = 18\sqrt{3}$

3. Given the indicated parts of ΔABC with $\gamma = 90°$, express the third part in terms of the first two.

$\beta, a; c$

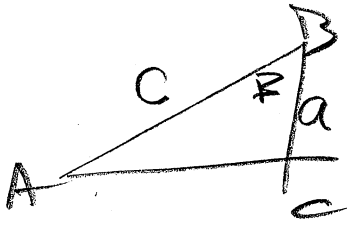
A. $c = a \sin\beta$

B. $c = a \sec\beta$

C. $c = a \tan\beta$

D. $c = a \csc\beta$

E. $c = a \cot\beta$

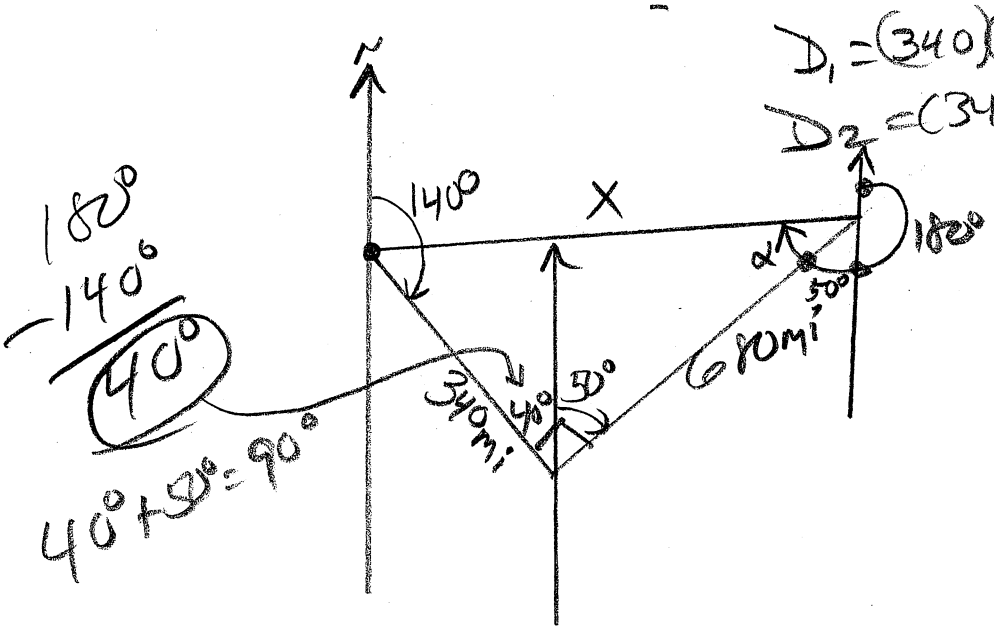


$\cos\beta = \frac{a}{c}$

$c = \frac{a}{\cos\beta}$

$c = a \sec\beta$

Questions 4 and 5: An airplane, flying at a speed of 340 mph, flies from a point A in the direction 140° for 1 hour and then flies in the direction 50° for 2 hours.



$D_1 = (340)(1) = 340$ mi

$D_2 = (340)(2) = 680$ mi

$180° - 140° = 40°$

$40° + 90° = 90°$

4. How long will it take to get back to point A? Round to the nearest tenth of an hour.

   A. 2.6 *hours*

   B. 2.4 *hours*

   C. 2.2 *hours*

   D. 2.0 *hours*

   E. 2.8 *hours*

$x^2 = 340^2 + 680^2$

$x = 760.263$

$D = rt$

$t = D/r$

$t = \frac{760.263}{340}$

$t = 2.2$ hr

5. In what direction does the plane need to fly in order to get back to points A? Round to the nearest whole degree.

   A. 257°

   B. 293°

   C. 248°

   D. 302°

   E. 198°

$\text{Direction} = 180° + 50° + \alpha$

$\tan\alpha = \frac{340}{680}$

$\alpha = \tan^{-1}(1/2)$

$\alpha = 27°$

$180° + 52° + 27° = 257°$

6. A ladder, 25 feet long, leans against the side of a building such that the angle between the ladder and the **ground** is 76°. If the bottom of the ladder is then moved 2 feet **closer** to the building, what angle, to the nearest tenth of a degree, does the ladder now make with the **ground?**

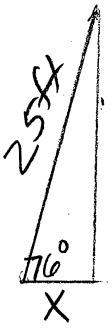
A. 83.6°

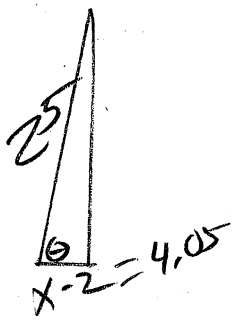
B. 81.2°

C. ~~80.7°~~

D. 82.4°

E. 83.0°





$\cos 76^\circ = \frac{x}{25}$

$x = 6.05$

$\cos\theta = \frac{4.05}{25}$

$\theta = \cos^{-1}(4.05/25)$

$\theta = 80.7^\circ$

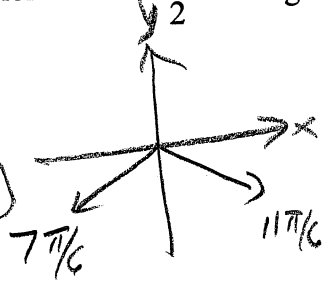
7. Find all solutions of the equation $\sin x = \frac{-1}{2}$ using n as an arbitrary integer.

A. $x = \frac{\pi}{2} + 2\pi n, \frac{3\pi}{2} + 2\pi n$

B. $x = \frac{7\pi}{6} + 2\pi n, \frac{11\pi}{6} + 2\pi n$

C. $x = \frac{5\pi}{4} + 2\pi n, \frac{7\pi}{4} + 2\pi n$

D. $x = \frac{4\pi}{3} + 2\pi n, \frac{5\pi}{3} + 2\pi n$



$\frac{7\pi}{6} + 2\pi n, \frac{11\pi}{6} + 2\pi n$

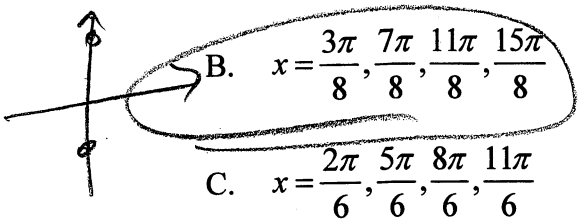
8. Find all solutions of the equation $\cos\left(2x-\frac{\pi}{4}\right)=0$ in the interval $[0,2\pi)$

A. $x=\frac{5\pi}{12},\frac{11\pi}{12},\frac{17\pi}{12},\frac{23\pi}{12}$

B. $x=\frac{3\pi}{8},\frac{7\pi}{8},\frac{11\pi}{8},\frac{15\pi}{8}$

C. $x=\frac{2\pi}{6},\frac{5\pi}{6},\frac{8\pi}{6},\frac{11\pi}{6}$

D. $x=\frac{\pi}{4},\frac{3\pi}{4},\frac{5\pi}{4},\frac{7\pi}{4}$



$2x-\frac{\pi}{4}=\frac{\pi}{2}+\pi n$

$2x=\frac{\pi}{2}+\frac{\pi}{4}+\pi n$

$2x=\frac{3\pi}{4}+\pi n$

$x=\frac{3\pi}{8}+\frac{\pi}{2}n$

$x=\frac{3\pi}{8}+\frac{4\pi}{8}n$

n	x
0	$3\pi/8$
1	$7\pi/8$
2	$11\pi/8$
3	$15\pi/8$

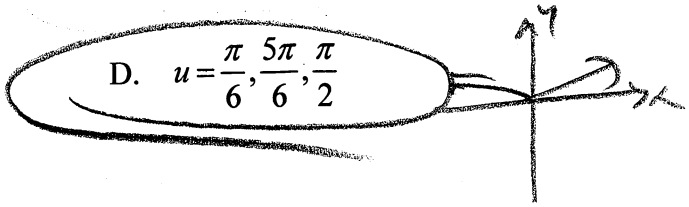
9. Find all solutions of the equation $2\sin^2 u-3\sin u+1=0$ in the interval $[0,2\pi)$

A. $u=\frac{4\pi}{3},\frac{5\pi}{3},\frac{3\pi}{2}$

B. $u=\frac{7\pi}{6},\frac{11\pi}{6},\frac{3\pi}{2}$

C. $u=\frac{\pi}{3},\frac{2\pi}{3},\frac{\pi}{2}$

D. $u=\frac{\pi}{6},\frac{5\pi}{6},\frac{\pi}{2}$



$(2\sin u-1)(\sin u-1)=0$

$2\sin u-1=0$ $\quad\sin u-1=0$

$\sin u=1/2$ $\quad\sin u=1$

$u=\frac{\pi}{6},\frac{5\pi}{6},\frac{\pi}{2}$

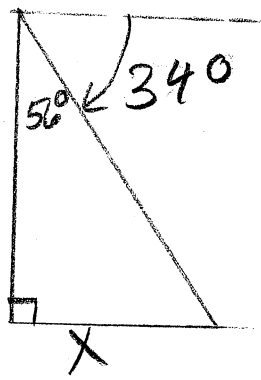
10. From a point 57 meters above level ground, a surveyor measures the **angle of depression** of an object on the ground at 34°. Approximate, to the nearest tenth, the distance from the object to the point on the ground directly beneath the surveyor.

A. $68.6m$

B. $47.3m$

C. $84.5m$

D. $101.1m$



90°
−34°
56°

$\tan 56° = \frac{x}{57}$

$57 \tan 56° = x$

$x = 84.5$

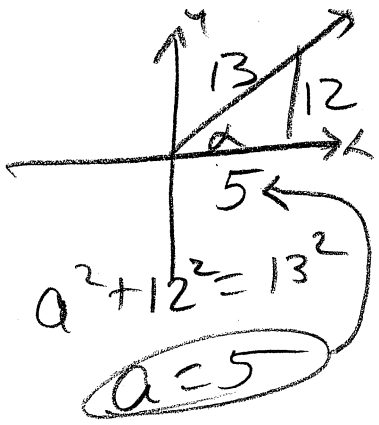
11. If $\sin\alpha = \frac{12}{13}$ and $\tan\beta = \frac{15}{8}$ for **acute** angles α and β, find $\cos(\alpha+\beta)$.

A. $\frac{-140}{221}$

B. $\frac{220}{221}$

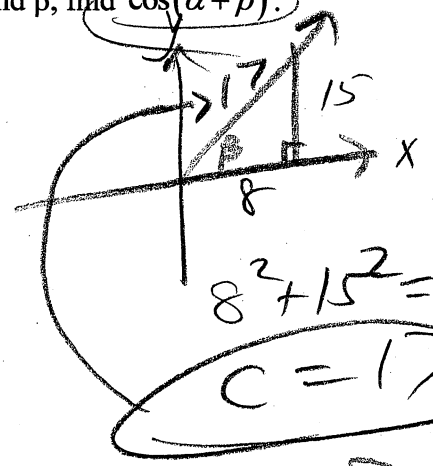
C. $\frac{-220}{221}$

D. $\frac{140}{221}$



$a^2 + 12^2 = 13^2$

$a = 5$



$8^2 + 15^2 = c^2$

$c = 17$

$\cos(\alpha+\beta) = \cos\alpha\cos\beta - \sin\alpha\sin\beta$

$= \left(\frac{5}{13}\right)\left(\frac{8}{17}\right) - \left(\frac{12}{13}\right)\left(\frac{15}{17}\right)$

$= \frac{40}{221} - \frac{180}{221} = \frac{-140}{221}$

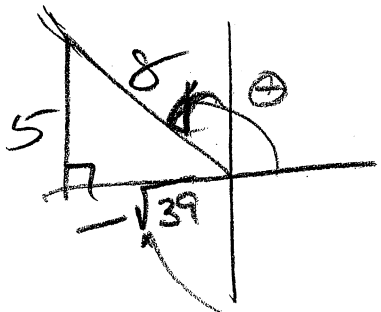
12. Find the exact value of $\sin(2\theta)$ for $\csc\theta = \frac{8}{5}$; $90° < \theta < 180°$

A. $\frac{7}{32}$

B. $\frac{5\sqrt{39}}{32}$

C. $\frac{-7}{32}$

D. $\frac{-5\sqrt{39}}{32}$



$\sin\theta = \frac{5}{8}$

$a^2 + 5^2 = 8^2$

$a = \pm\sqrt{39}$

$\sin 2\theta = 2\sin\theta\cos\theta$

$= 2\left(\frac{5}{8}\right)\left(\frac{-\sqrt{39}}{8}\right)$

$= \frac{-10\sqrt{39}}{64} = -\frac{5\sqrt{39}}{32}$

13. Find the solutions of the equation that are in the interval $[0, 2\pi)$.

$$\sin t + \sin 2t = 0$$

A. $\frac{\pi}{2}, \frac{3\pi}{2}, \frac{5\pi}{6}, \frac{7\pi}{6}$

B. $0, \pi, \frac{5\pi}{6}, \frac{7\pi}{6}$

C. $\frac{\pi}{2}, \frac{3\pi}{2}, \frac{2\pi}{3}, \frac{4\pi}{3}$

D. $0, \pi, \frac{2\pi}{3}, \frac{4\pi}{3}$

$\sin t + 2\sin t\cos t = 0$

$\sin t(1 + 2\cos t) = 0$

$\sin t = 0$ $\quad 1 + 2\cos t = 0$

$\cos t = -\frac{1}{2}$

$t = \frac{2\pi}{3}, \frac{4\pi}{3}$

$0, \frac{2\pi}{3}, \pi, \frac{4\pi}{3}$

14. If a projectile is fired from ground level with an initial velocity of v ft/sec and at an angle of θ degrees with the horizontal, the range R of the projectile is given by the formula.

$$R = \frac{v^2}{16}\sin\theta\cos\theta$$

If $v = 170$ ft/sec, approximate the angles that result in a range of 550 feet.
Please round your answers to the nearest tenth of a degree.

A. 42.6°, 47.4°

B. 18.8°, 71.2°

C. 37.5°, 52.5°

D. 21.3°, 68.7°

$550 = \frac{170^2}{16}\sin\theta\cos\theta$

$0.3045 = \sin\theta\cos\theta$

$0.6090 = 2\sin\theta\cos\theta$

$0.6090 = \sin(2\theta)$

$2\theta = \sin^{-1}(0.6090)$

$2\theta = 37.5$

$\theta = 18.7585°$

$\theta_1 = 18.8°$

$\theta_2 = 90° - 18.7585°$

$\theta_2 = 71.2°$

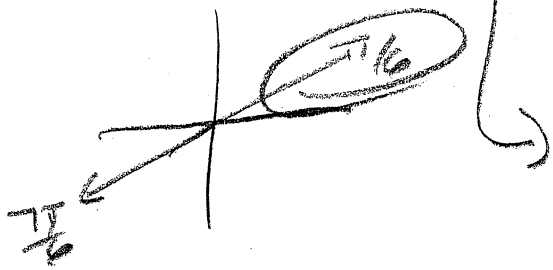
15. Find the exact value of $\tan^{-1}\left(\tan\frac{7\pi}{6}\right)$.

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

B. $\frac{5\pi}{6}$

C. $\frac{-\pi}{6}$

D. $\frac{7\pi}{6}$ (This is not the answer!)



OR:

$\tan^{-1}\left(\frac{1}{\sqrt{3}}\right)$

$\frac{\pi}{6}$