MA 15400 Exam 3 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:

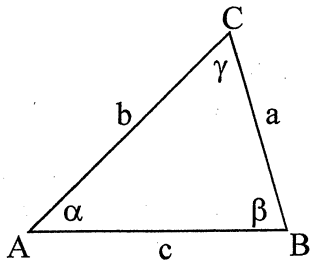
- You must use a #2 pencil on the answer sheet.
- On the answer sheet, fill in: (This has to be correct to find your score online.)
  a) Your last name, first name and middle initial and blacken the appropriate spaces.
  b) Your section number and blacken the appropriate spaces.
  c) Your 10-digit student 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.

$$\frac{\sin\alpha}{a}=\frac{\sin\beta}{b}=\frac{\sin\gamma}{c}$$

$$a^2=c^2+b^2-2cb\cos\alpha$$

$$b^2=a^2+c^2-2ac\cos\beta$$

$$c^2=a^2+b^2-2ab\cos\gamma$$



$$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$$

$$\sin(2u)=2\sin u\cos u$$

$$\cos(2u)=\cos^2 u-\sin^2 u$$

$$\tan(2u)=\frac{2\tan u}{1-\tan^2 u}$$

FINAL EXAM: Tuesday, May 5th, starting at 8:00 am (Yes, 8:00 AM)
Hall of Music, two hours, 30 questions, dress is casual

1. Find the perimeter of ΔABC, with $\gamma = 128°, \alpha = 31°, and\ a = 13.4\,cm$

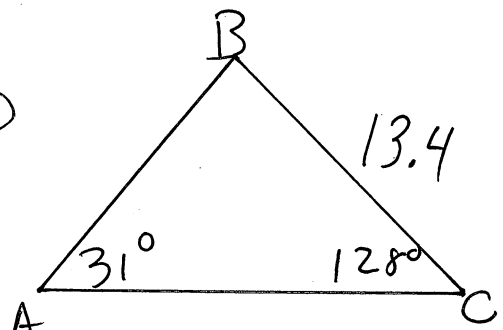
A. 41.6 *cm*

B. 43.2 *cm*

C. 44.5 *cm*

D. 39.8 *cm*

E. 47.9 *cm*



$\beta = 180° - (31° + 128°) = 21°$

$\frac{\sin 31°}{13.4} = \frac{\sin 128°}{c}$

$c = \frac{13.4 \sin 128°}{\sin 31°} = 20.5$

$\frac{\sin 31°}{13.4} = \frac{\sin 21°}{b}$

$b = \frac{13.4 \sin 21°}{\sin 31°} = 9.32$

$P = 13.4 + 9.3 + 20.5$

$P = 43.2$

2. The following information, $\alpha = 32°, a = 5\,cm, and\ b = 7cm$, yields two distinct ΔABC. Each has a different value for side *c*, angle β, and angle γ. Find the smaller value of *c*.

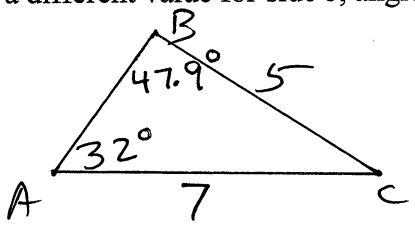
A. 4.9 *cm*

B. 5.4 *cm*

C. 3.7 *cm*

D. 2.6 *cm*

E. 1.8 *cm*

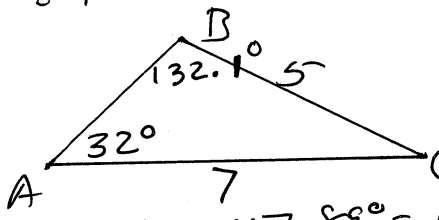


$\frac{\sin 32°}{5} = \frac{\sin \beta}{7}$

$\sin \beta = \frac{7 \sin 32°}{5}$

$\sin \beta = 0.7419$

$B_1 = 47.89°$



$B_2 = 180° - 47.89° = 132.11°$

$\gamma_1 = 180° - (32° + 47.9°)$

$\gamma_1 = 100.1°$

$\frac{\sin 32°}{5} = \frac{\sin 100.1°}{c_1}$

$c_1 = 9.3$

$\gamma_2 = 180° - (32° + 132.1°)$

$\gamma_2 = 15.9°$

$\frac{\sin 32°}{5} = \frac{\sin 15.9°}{c_2}$

$c_2 = 2.6$

3. As shown, a cable car travels from a point *A*, which is 18,500 ft. from a point *B* at the base of a mountain, to a point *P* at the top of the mountain. The angles of elevation of *P* from *A* and *B* are $\alpha = 20°$ and $\beta = 70°$. Approximate the height of the mountain.

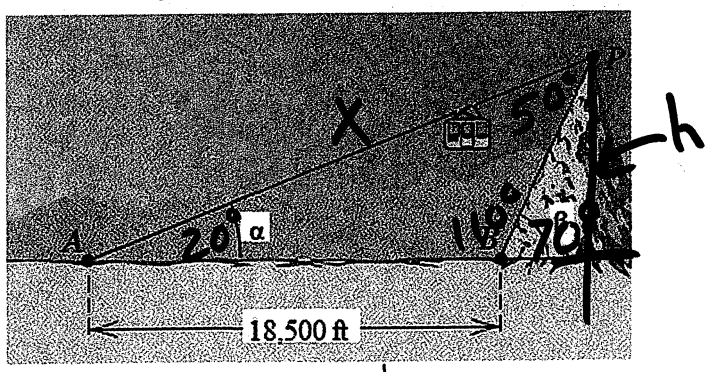
A. 8,260 *ft.*

B. 8,011 *ft.*

C. 7,762 *ft.*

D. 7,015 *ft.*

E. 6,873 *ft.*



$180° - 70° = 110°$

$180° - (20° + 110°) = 50°$

$\frac{\sin 50°}{18{,}500} = \frac{\sin 110°}{X}$

$X = 22693.6$

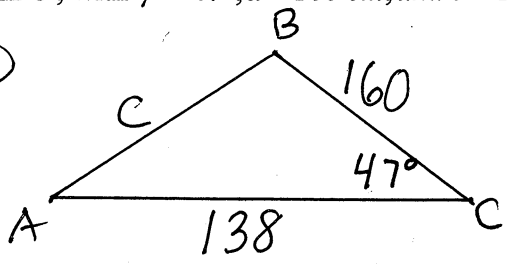
$\sin 20° = \frac{h}{22693.6}$

$h = 22693.6 \sin 20°$

$h = 7762$

4. Given ΔABC, with $\gamma = 47°, a = 160\ cm, and\ b = 138\ cm$, find the measure of angle α.

A. 76.1°
B. 56.9°
C. 62.4°
D. 70.6°
E. 66.5°



$C^2 = 138^2 + 160^2 - 2(138)(160)\cos 47°$

$C = 120.5278$

$\frac{\sin 47°}{120.5278} = \frac{\sin B}{138}$

$\sin B = \frac{138 \sin 47°}{120.5278}$

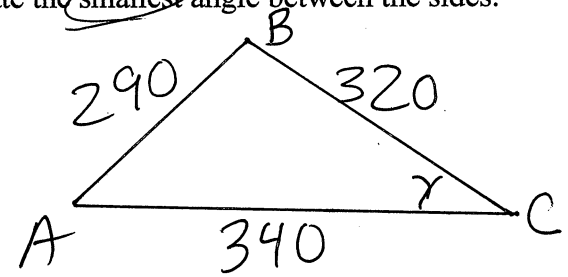
$B = 56.8638°$

$\alpha = 180° - (47° + 56.9°)$

$\alpha = 76.1°$

5. A triangular plot of land has sides of lengths 340 feet, 290 feet, and 320 feet. Approximate the smallest angle between the sides.

A. 46.2°
B. 59.8°
C. 67.5°
D. 52.0°
E. 60.4°



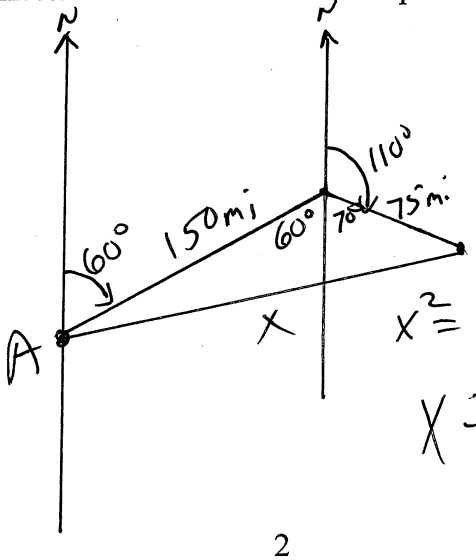
$290^2 = 340^2 + 320^2 - 2(340)(320)\cos\gamma$

$\cos\gamma = \frac{290^2 - 340^2 - 320^2}{-2(340)(320)}$

$\cos\gamma = 0.6153 \qquad \gamma = 52.0°$

6. An airplane flies 150 miles from point A in the direction 60° and then travels in the direction 110° for 75 miles. Find its distance back to point A.

A. 206 *miles*
B. 196 *miles*
C. 201*miles*
D. 181 *miles*
E. 189 *miles*



Alt. int. $60°$

$180° - 110° = 70°$

$70° + 60° = 130°$

$X^2 = 150^2 + 75^2 - 2(150)(75)\cos 130°$

$X = 206.3679$

7. A rhombus has sides of length 124 *cm*, and the angle at one of the vertices is 73°. Approximate the length of the longer diagonal.

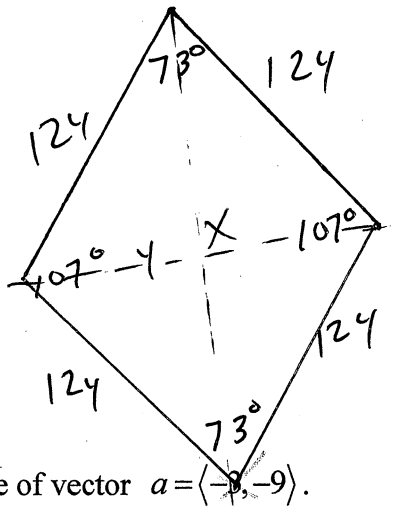
A. 173.6 *cm*

B. 160.1 *cm*

C. 157.5 *cm*

D. 185.3 *cm*

E. 199.4 *cm*



$180° - 73° = 107°$

$X^2 = 124^2 + 124^2 - 2(124)(124)\cos 107°$

$X = 199.4$

$Y^2 = 124^2 + 124^2 - 2(124)(124)\cos 73°$

$Y = 147.5$

8. Find the magnitude of vector $a = \langle -3, -9 \rangle$.

A. $\|a\| = 10.3$

B. $\|a\| = 9.5$

C. $\|a\| = 8.7$

D. $\|a\| = 11.7$

E. $\|a\| = 8.3$

$a = \langle -3, -9 \rangle$

$\|a\| = \sqrt{3^2 + 9^2}$

$= \sqrt{9 + 81}$

$= \sqrt{90} \approx 9.4868$

9. Find the least positive angle from the positive x-axis to the vector $a = \langle -3, -9 \rangle$.

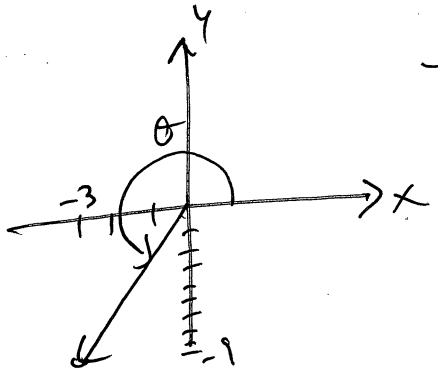
A. 225.0°

B. 211.7°

C. 198.4°

D. 268.3°

E. 251.6°



$\tan\theta = \frac{-9}{-3}$

$\theta = \tan^{-1}(3) + 180°$

$\theta = 71.565° + 180°$

$\theta = 251.565°$

Add 180° to $\tan^{-1}$ since QIII vector

10. Find a **unit vector** in the **same** direction as vector $c=-4i+7j$.

A. $u=4i-7j$

B. $u=\frac{4}{\sqrt{65}}i-\frac{7}{\sqrt{65}}j$

C. $u=-4i+7j$

D. $u=\frac{-4}{\sqrt{65}}i+\frac{7}{\sqrt{65}}j$

E. *Purdue Pete*

$$||c||=\sqrt{4^2+7^2}=\sqrt{16+49}$$

$$||c||=\sqrt{65}$$

$$u=\frac{1}{\sqrt{65}}(-4i+7j)$$

$$u=\frac{-4}{\sqrt{65}}i+\frac{7}{\sqrt{65}}j$$

11. Find the vector of **magnitude 6** that has the **opposite** direction as vector $c=-4i+7j$.

A. $24i-42j$

B. $\frac{24}{\sqrt{65}}i-\frac{42}{\sqrt{65}}j$

C. $-24i+42j$

D. $\frac{-24}{\sqrt{65}}i+\frac{42}{\sqrt{65}}j$

E. *Mitch Daniels*

$$-6u=6\left(\frac{-4}{\sqrt{65}}i+\frac{7}{\sqrt{65}}j\right)$$

$$=\frac{+24}{\sqrt{65}}i+\frac{-42}{\sqrt{65}}j$$

12. The magnitudes and directions of two forces acting at a point P are given. Approximate the magnitude of the resultant vector.

(a) 80*lb*,130° (b) 35*lb*,190°

A. 69.5 *lb*

B. 94.8 *lb*

C. 102.1 *lb*

D. 76.7 *lb*

E. 85.3 *lb*

a: $\langle 80\cos 130°, 80\sin 130° \rangle$

b: $\langle 35\cos 190°, 35\sin 190° \rangle$

r: $\langle -85.8913, 55.2059 \rangle$

$\|r\| = \sqrt{x^2+y^2} = 102.1029$ lb

HAD it Asked for Direction of resultant:

$\tan\theta = \frac{y}{x} = \frac{55.2}{-85.9} = -0.6427$

Since QII resultant $+180°$

$\theta = \tan^{-1}(-0.6427) + 180°$

$\theta = -32.7° + 180°$

$\theta = 147.3°$

13. An airplane is flying in the direction 100° with an airspeed of 500 mph, and a 40 mph wind is blowing in the direction 35°. Approximate the true course of the airplane.

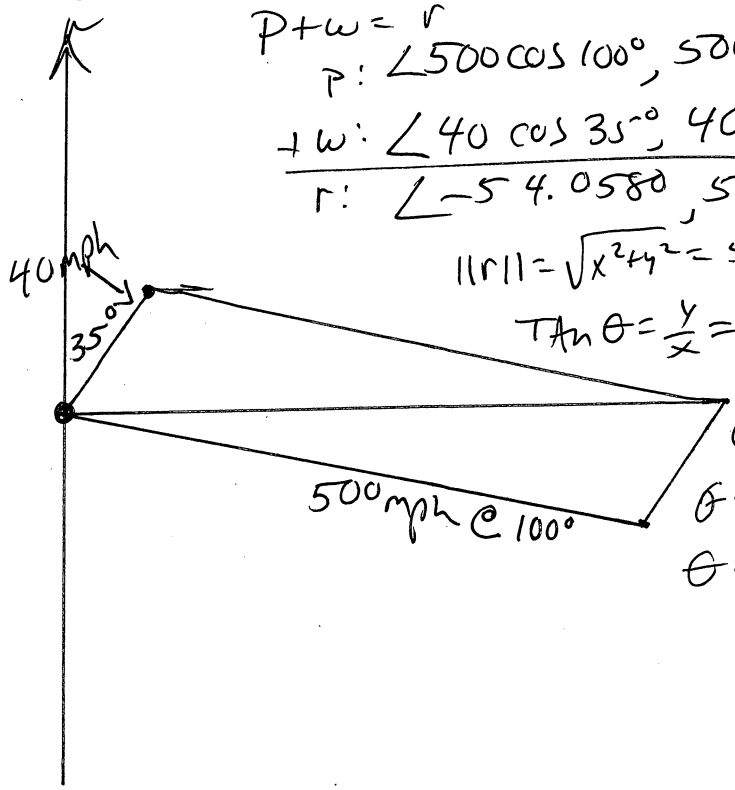
A. 96.0°

B. 75.8°

C. 84.0°

D. 92.3°

E. 67.5°



$P + w = r$

P: $\langle 500\cos 100°, 500\sin 100° \rangle$

+ w: $\langle 40\cos 35°, 40\sin 35° \rangle$

r: $\langle -54.0580, 515.3469 \rangle$

$\|r\| = \sqrt{x^2+y^2} = 518.1744$ mph

$\tan\theta = \frac{y}{x} = \frac{515.3}{-54.1} = -9.5$

$\theta = \tan^{-1}(\quad) + 180°$

$\theta = -84.0° + 180°$

$\theta = 95.9882°$

Hello Radians, my old friend. I've come to talk with you again.
Change the mode of your calculator to Radians!

14. Find the solutions of the equation in the interval $[0, 2\pi)$, and approximate the solutions to two decimal places. $4\cos^2 t + 7\cos t - 6 = 0$

A. 0.68, 2.46

B. 0.89, 5.39

C. Barack Obama

D. 0.68, 5.60

E. 0.89, 2.25

$\cos t = \frac{-7 \pm \sqrt{49 - 4(4)(-6)}}{2(4)} = \frac{-7 \pm \sqrt{145}}{8}$

$\cos t = \frac{-7 - \sqrt{145}}{8}$

$\cos t = -2.3802$

no solution

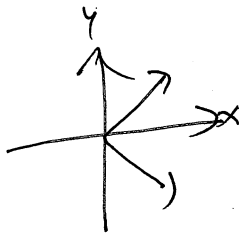
$\cos t = \frac{-7 + \sqrt{145}}{8}$

$\cos t = 0.6302$

$t = \cos^{-1}(0.6302)$

$t_1 = 0.8890$

$t_2 = 2\pi - 0.8890 = 5.39$



15. Two of the solutions of the given equation are $\frac{\pi}{2}$ *and* $\frac{3\pi}{2}$. Approximate the other two solutions, in the interval $[0, 2\pi)$, to two decimal places.

$$4\sin(2\theta) = -7\cos\theta$$

A. Vladimir Putin

B. 4.02, 5.41

C. 4.21, 2.08

D. 4.02, 2.27

E. 4.21, 5.22

$4(2\sin\theta\cos\theta) = -7\cos\theta$

$8\sin\theta\cos\theta + 7\cos\theta = 0$

$\cos\theta(8\sin\theta + 7) = 0$

$\cos\theta = 0$

$\theta = \frac{\pi}{2}, \frac{3\pi}{2}$

$8\sin\theta + 7 = 0$

$\sin\theta = -\frac{7}{8}$

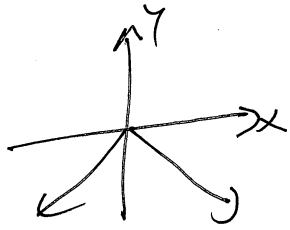
$\theta = \sin^{-1}(-\frac{7}{8})$

$\theta = \sin^{-1}(-0.875)$

$\theta = -1.07 \quad \theta_2 = 1.07$

$\theta_1 = \pi + 1.07 = 4.21$

$\theta_2 = 2\pi - 1.07 = 5.22$



MA 15400, Spring 2015
Exam 3

Question	Answer	Form 01 Green	Form 02 Orange
1.	$43.2\,cm$	B	B
2.	$2.6\,cm$	D	D
3.	$7{,}762\ ft.$	C	C
4.	$76.1°$	A	A
5.	$52.0°$	D	D
6.	$206\ miles$	A	A
7.	$199.4\,cm$	E	E
8.	$\|\|a\|\| = 9.5$	B	B
9.	$251.6°$	E	E
10.	$u = \frac{-4}{\sqrt{65}}i + \frac{7}{\sqrt{65}}j$	D	D
11.	$\frac{24}{\sqrt{65}}i - \frac{42}{\sqrt{65}}j$	B	B
12.	$102.1\ lb$	C	C
13.	$96.0°$	A	A
14.	$0.89, 5.39$	B	B
15.	$4.21, 5.22$	E	E