

Math 375
Spring 2026
Exam ~~2~~₃, April 10

No books, notes, scratch paper, phones.
Please show all your work and clearly mark your answers.
Problems are 5 points unless noted.
If a problem is too hard, move on to an easier one.
No calculators on problems 1-9.

Page	Pts.	Possible
1		15
2		15
3		10
4		10
5		10
6		10
7		15
8		15
Total		100

Name (printed):

Key

Name (signature):

Score for the
class so far:

_____ out of _____ points

Percent:

_____ %

Approximate letter grade:

To earn a grade of _____ I would need about
of the points in the rest of the class.

- 1) a) Write the 3 cosine double-angle formulas.
 b) From the appropriate cosine double-angle formula, derive the sine half-angle formula.



$$\begin{aligned} \cos(2\theta) &= \cos^2(\theta) - \sin^2(\theta) \\ &= 2\cos^2(\theta) - 1 \\ &= 1 - 2\sin^2(\theta) \end{aligned}$$

$$\cos(2\theta) = 1 - 2\sin^2(\theta)$$

$$\theta = \frac{u}{2}$$

$$\cos(u) = 1 - 2\sin^2\left(\frac{u}{2}\right)$$

$$2\sin^2\left(\frac{u}{2}\right) = 1 - \cos(u)$$

$$\sin^2\left(\frac{u}{2}\right) = \frac{1 - \cos(u)}{2}$$

$$\sin\left(\frac{u}{2}\right) = \pm \sqrt{\frac{1 - \cos(u)}{2}}$$

- 2) Find two vectors, in opposite directions, perpendicular to $\langle 8, -3 \rangle$.



$$\langle 3, 8 \rangle \quad \langle -3, -8 \rangle$$

- 3) Simplify:

$$(8 + 7i) \div (2 + 5i)$$

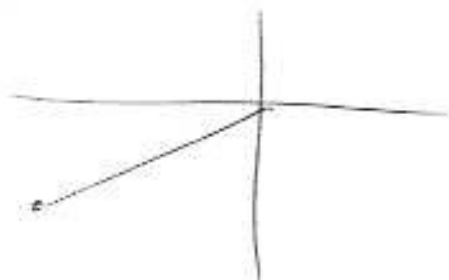
$$\frac{(8 + 7i)(2 - 5i)}{(2 + 5i)(2 - 5i)} = \frac{16 + 35 - 40i + 14i}{4 + 25} = \frac{51 - 26i}{29}$$

$$= \frac{51}{29} - \frac{26}{29}i$$

4) Convert rectangular to polar:

a) $(0, -9)$

b) $(-10\sqrt{3}, -10)$



a) $r=9 \quad \theta=270^\circ$

b) $r=20 \quad \theta=210^\circ$

5) Complete this sum-to-product formula:

(10 pts)

$$\frac{1}{2}[\cos(A+B) - \cos(A-B)] = \dots$$

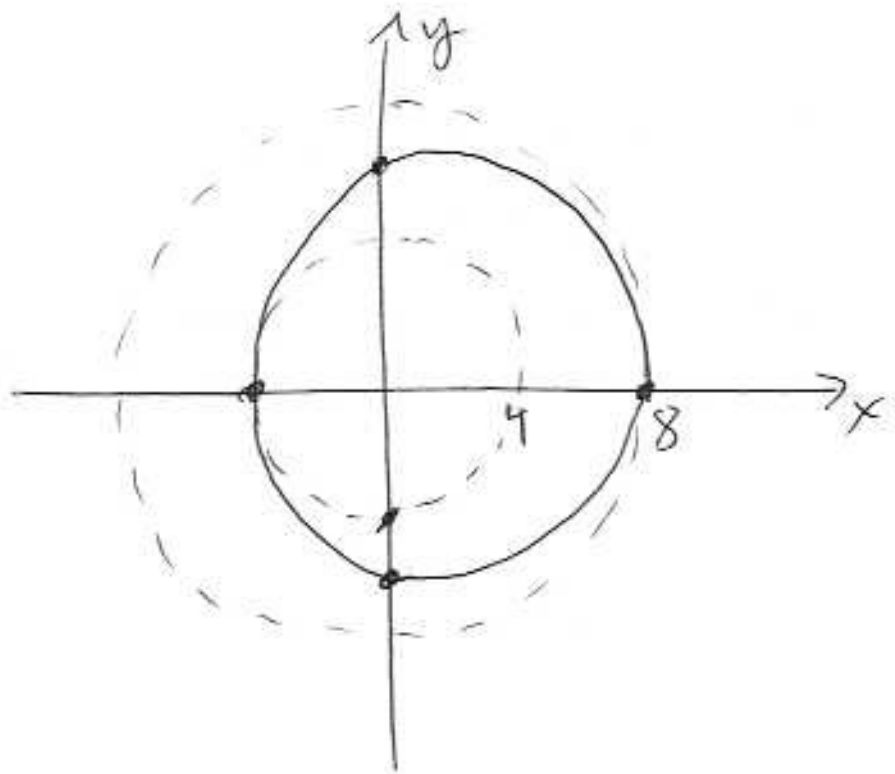
$$= \frac{1}{2} (\cancel{\cos A \cos B} - \sin A \sin B - (\cancel{\cos A \cos B} + \sin A \sin B))$$

$$= \frac{1}{2} (-2 \sin A \sin B) = -\sin A \sin B$$

6) Graph in polar coordinates:

$$r = 6 + 2\cos(\theta)$$

θ	$\cos\theta$	r
0°	1	8
90°	0	6
180°	-1	4
270°	0	6
360°	1	8



7) List the five categories of the Basic Trig Identities.

- Reciprocal
- Quotient
- Pythagorean
- Symmetry
- Cofunction

8) Evaluate $\sin(165^\circ)$.

$$\begin{aligned} & \sin(135^\circ + 30^\circ) \\ &= \sin 135^\circ \cos 30^\circ + \sin 30^\circ \cos 135^\circ \\ &= \frac{\sqrt{2}}{2} \frac{\sqrt{3}}{2} + \frac{1}{2} \left(-\frac{\sqrt{2}}{2} \right) = \frac{\sqrt{6} - \sqrt{2}}{4} \end{aligned}$$

9) Two sides of a triangle are 100 units and 60 units.

Fill in: The third side must be more than 40 units.

Name:

Key

1) Solve this triangle:

(10 pts)

$$A = 59.8^\circ$$

$$c = 49.5 \text{ inches}$$

$$a = 44.5 \text{ inches}$$

$$\sin C = \frac{c \sin(A)}{a} = 0.9614$$

$$C = 74.0^\circ$$

$$B = 46.2^\circ$$

or

$$C = 106.0^\circ$$

$$B = 14.2^\circ$$

$$b = \frac{\sin(B) a}{\sin(A)}$$

$$b = 37.1 \text{ inches}$$

$$b = 12.7 \text{ inches}$$

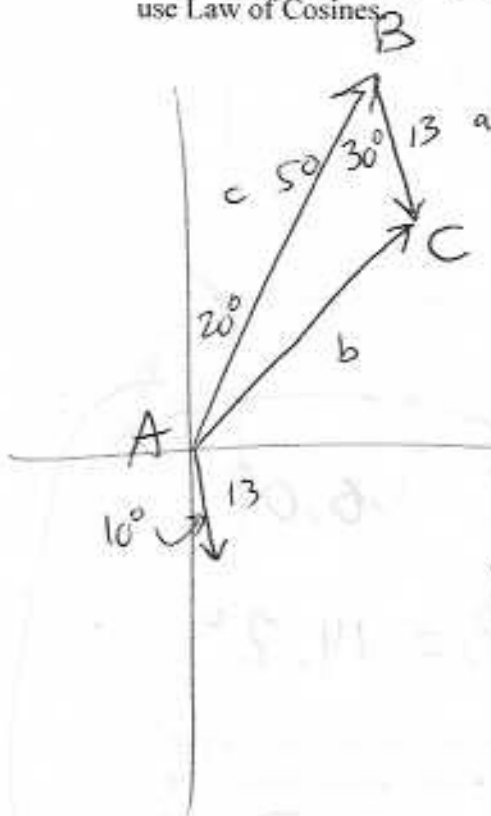


2) Add these two vectors. Write the magnitude and direction of the final vector.

u is 50 units long, and the angle is 20° clockwise from north

v is 13 units long, and the angle is 170° clockwise from north

You may convert to components, add, and convert back. But it is faster to create a triangle and use Law of Cosines. (10 pts)



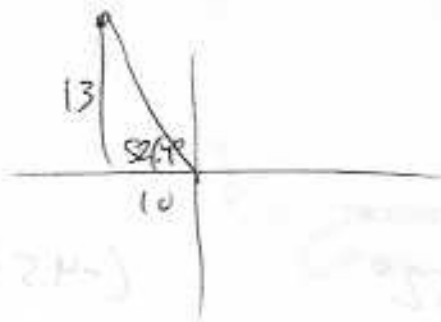
$$b^2 = a^2 + c^2 - 2ac \cdot \cos(B)$$

$$b = 39.3 \text{ units}$$

$$\sin A = \frac{a \sin B}{b}$$

$$A = 9.5^\circ$$

29.5° clockwise from north



3) Write in polar form:
 $-10 + 13i$

$$16.4 \left(\cos(127.6^\circ) + i \sin(127.6^\circ) \right)$$

4) Solve on $[0, 2\pi]$. Show work.

(10 pts)

$$4\sin^2\theta + 11\sin\theta + 6 = 0$$

$$4u^2 + 11u + 6 = 0$$

$$u = \frac{-11 \pm \sqrt{121 - 96}}{8} = -11 \pm \sqrt{\dots}$$

$$(4u + 3)(u + 2)$$

$$\sin(\theta) = -\frac{3}{4}$$

$$u = -\frac{3}{4}, \quad \cancel{-2}$$

$$\theta = 48.59^\circ \rightarrow Q3, Q4$$

$$228.6^\circ, \quad 311.4^\circ$$

Two more on the back

~~$$3.990$$~~

$$3.990 \text{ radians}$$

$$5.435 \text{ radians}$$

5) Convert polar to rectangular:

(10 pts)

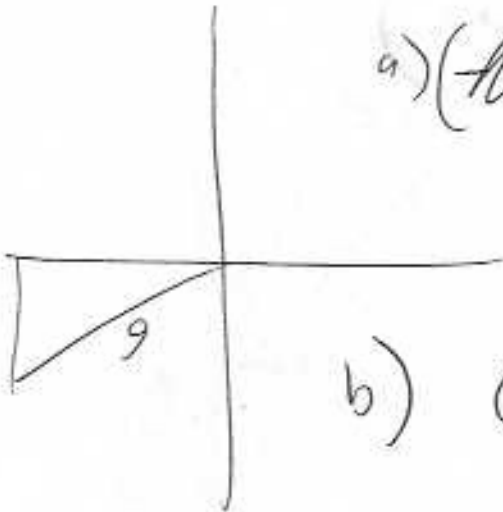
a) $(9, 210^\circ)$

b) $(-2, \frac{11\pi}{13})$

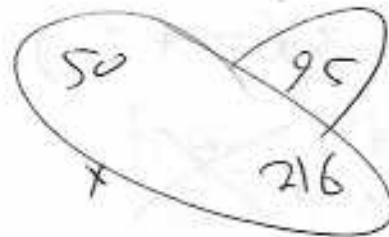
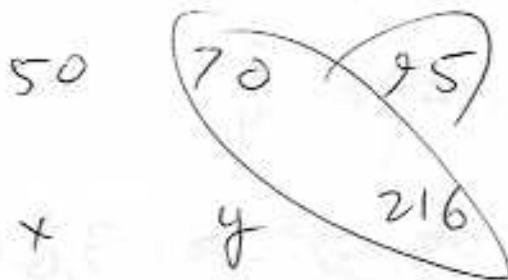
$(-4.5\sqrt{3}, -4.5)$

a) ~~$(-4.5\sqrt{3}, -4.5)$~~ or ~~$(-7.8, -4.5)$~~

b) $(1.77, -0.93)$



6) Two triangles are similar. The first triangle has sides 50 mm, 70 mm, and 95 mm. The largest side on the second triangle is 216 inches. Find the other two sides on the second triangle.



$y = 159$ inches

$x = 114$ inches