

## MATH 130 FINAL REVIEW version2

Problems 1 – 3 refer to triangle  $ABC$ , with  $C = 90^\circ$ . Find the remaining angle(s) and side(s).

1.  $A = 50^\circ$ ,  $a = 25 \text{ ft}$

a)  $B = 40^\circ$ ,  $b = 32.6 \text{ ft}$ ,  $c = 21.0 \text{ ft}$

b)  $B = 50^\circ$ ,  $b = 21.0 \text{ ft}$ ,  $c = 32.6 \text{ ft}$

c)  $B = 40^\circ$ ,  $b = 21.0 \text{ ft}$ ,  $c = 32.6 \text{ ft}$

d)  $B = 50^\circ$ ,  $b = 32.6 \text{ ft}$ ,  $c = 21.0 \text{ ft}$

2.  $a = 9 \text{ cm}$ ,  $b = 12 \text{ cm}$

a)  $A = 48.6^\circ$ ,  $B = 41.4^\circ$ ,  $c = 3\sqrt{7} \text{ cm}$

b)  $A = 41.4^\circ$ ,  $B = 48.6^\circ$ ,  $c = 3\sqrt{7} \text{ cm}$

c)  $A = 53.1^\circ$ ,  $B = 36.9^\circ$ ,  $c = 15 \text{ cm}$

d)  $A = 36.9^\circ$ ,  $B = 53.1^\circ$ ,  $c = 15 \text{ cm}$

3.  $B = 55^\circ 42'$ ,  $c = 8.85 \text{ inches}$

a)  $A = 34^\circ 58'$ ,  $a = 4.98 \text{ inches}$ ,  $b = 7.29 \text{ inches}$

b)  $A = 34^\circ 18'$ ,  $a = 4.99 \text{ inches}$ ,  $b = 7.31 \text{ inches}$

c)  $A = 34^\circ 58'$ ,  $a = 4.99 \text{ inches}$ ,  $b = 7.31 \text{ inches}$

d)  $A = 34^\circ 18'$ ,  $a = 5.08 \text{ inches}$ ,  $b = 7.25 \text{ inches}$

For problems 4 – 5, find the remaining five trig functions of  $\theta$  if:

4.  $\sin \theta = -\frac{12}{15}$  and  $\theta$  terminates in Quadrant III.

a)  $\csc \theta = -\frac{15}{12}$

b)  $\csc \theta = \frac{15}{12}$

c)  $\csc \theta = -\frac{15}{12}$

d)  $\csc \theta = \frac{15}{12}$

$\cos \theta = \frac{9}{15}$

$\cos \theta = -\frac{9}{15}$

$\cos \theta = -\frac{9}{15}$

$\cos \theta = \frac{9}{15}$

$\sec \theta = \frac{15}{9}$

$\sec \theta = -\frac{15}{9}$

$\sec \theta = -\frac{15}{9}$

$\sec \theta = \frac{15}{9}$

$\tan \theta = -\frac{12}{9}$

$\tan \theta = -\frac{12}{9}$

$\tan \theta = \frac{12}{9}$

$\tan \theta = \frac{12}{9}$

$\cot \theta = -\frac{9}{12}$

$\cot \theta = -\frac{9}{12}$

$\cot \theta = \frac{9}{12}$

$\cot \theta = \frac{9}{12}$

5.  $\tan \theta = -\frac{1}{3}$  and  $\theta$  terminates in Quadrant II.

- |  |                                       |                                       |  |
|--|---------------------------------------|---------------------------------------|--|
| a) $\cot \theta = -3$                  | b) $\cot \theta = -3$                 | c) $\cot \theta = -3$                 | d) $\cot \theta = -3$                  |
| $\sin \theta = \frac{\sqrt{10}}{10}$   | $\sin \theta = -\frac{\sqrt{10}}{10}$ | $\sin \theta = \frac{3\sqrt{10}}{10}$ | $\sin \theta = -\frac{3\sqrt{10}}{10}$ |
| $\csc \theta = \sqrt{10}$              | $\csc \theta = -\sqrt{10}$            | $\csc \theta = \frac{\sqrt{10}}{3}$   | $\csc \theta = -\frac{\sqrt{10}}{3}$   |
| $\cos \theta = -\frac{3\sqrt{10}}{10}$ | $\cos \theta = \frac{3\sqrt{10}}{10}$ | $\cos \theta = -\frac{\sqrt{10}}{10}$ | $\cos \theta = \frac{\sqrt{10}}{10}$   |
| $\sec \theta = -\frac{\sqrt{10}}{3}$   | $\sec \theta = \frac{\sqrt{10}}{3}$   | $\sec \theta = -\sqrt{10}$            | $\sec \theta = \sqrt{10}$              |

For problems 6 - 7, find the requested trig function:

6. If  $\cot \theta = -\frac{2}{3}$  and  $\sin \theta > 0$ , then  $\sec \theta =$

- |                          |                          |                           |                           |
|--------------------------|--------------------------|---------------------------|---------------------------|
| a) $\frac{\sqrt{13}}{2}$ | b) $\frac{2}{\sqrt{13}}$ | c) $-\frac{\sqrt{13}}{2}$ | d) $-\frac{2}{\sqrt{13}}$ |
|--------------------------|--------------------------|---------------------------|---------------------------|

7. If  $\sec \theta = \sqrt{5}$  and  $\tan \theta < 0$ , then  $\csc \theta =$

- |                           |                         |                |                          |
|---------------------------|-------------------------|----------------|--------------------------|
| a) $-\frac{2\sqrt{5}}{5}$ | b) $\frac{\sqrt{5}}{2}$ | c) $-\sqrt{6}$ | d) $-\frac{\sqrt{5}}{2}$ |
|---------------------------|-------------------------|----------------|--------------------------|

For problems 8 – 9, simplify after making the given substitution

8.  $\sqrt{16 - 16x^2}$ ,  $x = \cos \theta$

- |                     |                    |                     |                      |
|---------------------|--------------------|---------------------|----------------------|
| a) $16 \sin \theta$ | b) $4 \sin \theta$ | c) $4 \sin \theta $ | d) $16 \sin \theta $ |
|---------------------|--------------------|---------------------|----------------------|

9.  $\sqrt{x^2 + 9}$ ,  $x = 3 \cot \theta$

- |                     |                    |                    |                      |
|---------------------|--------------------|--------------------|----------------------|
| a) $3 \csc \theta $ | b) $3 \csc \theta$ | c) $9 \csc \theta$ | d) $9  \csc \theta $ |
|---------------------|--------------------|--------------------|----------------------|

For problems 10 – 11, perform the operation and simplify. Answers should be in terms of  $\sin \theta$  and/or  $\cos \theta$ .

10.  $\frac{\sin^2 \theta - \tan^2 \theta}{1 - \sec^2 \theta} =$

- |                    |                    |                     |                     |
|--------------------|--------------------|---------------------|---------------------|
| a) $\cos^2 \theta$ | b) $\sin^2 \theta$ | c) $-\sin^2 \theta$ | d) $-\cos^2 \theta$ |
|--------------------|--------------------|---------------------|---------------------|

11.  $\sec^3 \theta - \tan^2 \theta \sec \theta =$

a)  $\frac{1}{\cos \theta}$

b)  $\cos \theta$

c)  $\frac{\sin^2 \theta}{\cos^2 \theta}$

d)  $\frac{1}{\cos^2 \theta}$

For problems 12 – 13, write in terms of  $\sin \theta$  and/or  $\cos \theta$  and simplify.

12.  $\frac{1}{\csc \theta \tan \theta}$

a)  $\cos \theta$

b)  $\frac{\sin^2 \theta}{\cos \theta}$

c)  $\frac{1}{\cos \theta}$

d)  $\frac{\cos \theta}{\sin^2 \theta}$

13.  $\tan \theta + \cot \theta$

a)  $\sin \theta \cos \theta$

b)  $\frac{1}{\sin \theta \cos \theta}$

c)  $\frac{1}{\sin \theta}$

d)  $\frac{\sin^2 \theta}{\cos^2 \theta}$

For problems 14 – 15, give an angle between  $0^\circ$  and  $360^\circ$  coterminal with the given angle.

14.  $-155^\circ$

a)  $155^\circ$

b)  $205^\circ$

c)  $25^\circ$

d)  $115^\circ$

15.  $475^\circ$

a)  $15^\circ$

b)  $215^\circ$

c)  $115^\circ$

d)  $205^\circ$

For problems 16 - 20, evaluate without using a calculator.

16.  $\arcsin\left(-\frac{\sqrt{2}}{2}\right)$

a)  $\frac{\pi}{4}$

b)  $\frac{5\pi}{4}, \frac{7\pi}{4}$

c)  $\frac{7\pi}{4}$

d)  $-\frac{\pi}{4}$

17.  $\tan^{-1}(\sqrt{3})$

a)  $\frac{\pi}{3}$

b)  $\frac{\pi}{3}, \frac{4\pi}{3}$

c)  $\frac{\pi}{6}$

d)  $\frac{\pi}{6}, \frac{7\pi}{6}$

18.  $\sin\left(\cos^{-1}\left(-\frac{1}{2}\right)\right)$

a)  $\frac{1}{2}$

b)  $-\frac{1}{2}$

c)  $-\frac{\sqrt{3}}{2}$

d)  $\frac{\sqrt{3}}{2}$

19.  $\sin^{-1}(\tan 135^\circ)$

a)  $-90^\circ$

b)  $90^\circ$

c)  $270^\circ$

d)  $0^\circ$

20.  $\sec\left(\tan^{-1}\left(\frac{1}{2x}\right)\right)$

a)  $\sqrt{4x^2 + 1}$

b)  $\frac{\sqrt{4x^2 + 1}}{2x}$

c)  $\frac{\sqrt{2x^2 + 1}}{2x}$

d)  $\frac{2x}{\sqrt{4x^2 + 1}}$

**For problems 21 and 22,  $\theta$  is a central angle in a circle of radius  $r$ . Find the requested value.**

21.  $\theta = \frac{3\pi}{4}$ ,  $r = 4$  inches. Find the arc length  $s$ .

a)  $\frac{3\pi}{16}$  inches

b)  $12\pi$  inches

c)  $3\pi$  inches

d)  $6\pi$  inches

22.  $\theta = 72^\circ$ ,  $r = 5$  m. Find the area of the sector.

a)  $5\pi$   $m^2$

b)  $10\pi$   $m^2$

c)  $900\pi$   $m^2$

d)  $\frac{\pi}{5}$   $m^2$

**For problems 23 – 25, Identify the amplitude, period, phase (horizontal) shift, and vertical shift.**

23.  $y = 1 - 3 \sin(2x + \pi)$

a) Amp = 3

b) Amp = 3

c) Amp = -3

d) Amp = 3

Per =  $2\pi$

Per =  $\pi$

Per =  $\pi$

Per =  $\pi$

HS =  $-\frac{\pi}{2}$

HS =  $\frac{\pi}{2}$

HS =  $-\frac{\pi}{2}$

HS =  $-\frac{\pi}{2}$

VS = 1

VS = 1

VS = 1

VS = 1

$$24. y = 2 + 2 \sec\left(x - \frac{\pi}{4}\right)$$

a) Amp = none

Per =  $2\pi$

HS =  $\frac{\pi}{4}$

VS = 2

b) Amp = none

Per =  $2\pi$

HS =  $-\frac{\pi}{4}$

VS = 2

c) Amp = 2

Per =  $2\pi$

HS =  $\frac{\pi}{4}$

VS = 2

d) Amp = 2

Per =  $\pi$

HS =  $-\frac{\pi}{4}$

VS = 2

$$25. y = \tan\left(2x - \frac{\pi}{2}\right)$$

a) Amp = 1

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

HS =  $\frac{\pi}{4}$

VS = 0

b) Amp = none

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

HS =  $\frac{\pi}{4}$

VS = 0

c) Amp = 1

Per =  $\pi$

HS =  $-\frac{\pi}{4}$

VS = 0

d) Amp = none

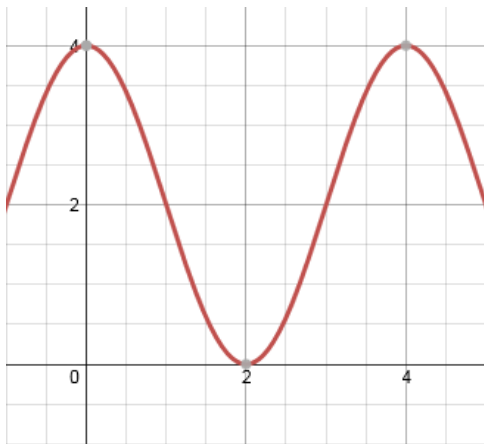
Per =  $\pi$

HS =  $\frac{\pi}{2}$

VS = 0

For problem 26, find the equation that matches the graph.

26.



a)  $y = 2 + 2 \cos\left(\frac{\pi x}{2}\right)$

b)  $y = 2 + 2 \cos 2\pi x$

c)  $y = 4 + \cos\left(\frac{\pi x}{2}\right)$

d)  $y = 2 + 2 \cos\left(\frac{x}{2}\right)$



For problems 35 – 36, find all solutions in the interval  $0^\circ \leq \theta < 360^\circ$ .

35.  $2 \sin \theta - 2 = 0$

- a)  $0^\circ, 180^\circ$                       b)  $270^\circ$                       c)  $90^\circ$                       d)  $30^\circ, 150^\circ$

36.  $\tan^2 \theta + \tan \theta = 0$

- a)  $0^\circ, 180^\circ$                       b)  $135^\circ, 315^\circ$   
c)  $45^\circ, 90^\circ, 225^\circ, 270^\circ$                       d)  $0^\circ, 135^\circ, 180^\circ, 315^\circ$

For problems 37 – 38, find all solutions in the interval  $0 \leq x < 2\pi$ .

37.  $4 \cos^2 x - 4 \sin x - 5 = 0$

- a)  $\frac{\pi}{6}, \frac{5\pi}{6}$                       b)  $\frac{7\pi}{6}, \frac{11\pi}{6}$                       c)  $\frac{\pi}{3}, \frac{2\pi}{3}$                       d)  $\frac{4\pi}{3}, \frac{5\pi}{3}$

38.  $\cos 2x \cos x + \sin 2x \sin x = \frac{1}{2}$

- a)  $\frac{\pi}{3}, \frac{2\pi}{3}$                       b)  $\frac{\pi}{6}, \frac{11\pi}{6}$                       c)  $\frac{\pi}{3}$                       d)  $\frac{\pi}{3}, \frac{5\pi}{3}$

For problem 39, find all solutions. Write the answer in radians using exact values.

39.  $(\cos 4x)^2 = 1$

- a)  $\frac{\pi}{2} k$                       b)  $2\pi k$                       c)  $\frac{\pi}{4} k$                       d)  $\frac{\pi}{8} + \frac{\pi}{2} k$

For problems 40 - 42, refer to triangle ABC which is not necessarily a right triangle. Find the requested value(s).

40. If  $B = 110^\circ$ ,  $C = 40^\circ$ , and  $b = 18.0$  inches, find  $a$ .

- a) 9.6 inches                      b) 12.3 inches                      c) not enough information                      d) 33.8 inches

41. If  $a = 3.7$  m,  $c = 6.4$  m, and  $B = 23^\circ$ , find  $b$ .

- a) 3.3 m                      b) 4.1 m                      c) 5.7 m                      d) 11.1 m

42. If  $a = 51$  cm,  $b = 24$  cm, and  $c = 31$  cm, find the smallest angle.

- a)  $15^\circ$                       b)  $19^\circ$                       c)  $25^\circ$                       d)  $38^\circ$





50.  $\frac{15(\cos 225^\circ + i \sin 225^\circ)}{5(\cos 45^\circ + i \sin 45^\circ)}$

a)  $3 \operatorname{cis} 270^\circ$

b)  $5 \operatorname{cis} 180^\circ$

c)  $75 \operatorname{cis} 270^\circ$

d)  $3 \operatorname{cis} 180^\circ$

51.  $(\sqrt{3} \operatorname{cis} 110^\circ)^6$

a)  $6\sqrt{3} \operatorname{cis} 660^\circ$

b)  $6\sqrt{3} \operatorname{cis} 300^\circ$

c)  $27 \operatorname{cis} 300^\circ$

d)  $27 \operatorname{cis} 360^\circ$

**For problem 52, use DeMoivre's Theorem and convert the answer back to standard form.**

52.  $(1 - i)^4$

a)  $-4$

b)  $4i$

c)  $4$

d)  $-4i$

**For problems 53 – 54, find the indicated roots. Leave the answers in trigonometric form.**

53. Find two square roots of  $z = 81(\cos 120^\circ + i \sin 120^\circ)$ .

a)  $3 \operatorname{cis} 60^\circ, 3 \operatorname{cis} 300^\circ$

b)  $9 \operatorname{cis} 60^\circ, 9 \operatorname{cis} 240^\circ$

c)  $3 \operatorname{cis} 60^\circ, 3 \operatorname{cis} 240^\circ$

d)  $9 \operatorname{cis} 120^\circ, 9 \operatorname{cis} 300^\circ$

54. Find three cube roots of  $z = -4\sqrt{3} + 4i$ .

a)  $4 \operatorname{cis} 50^\circ, 4 \operatorname{cis} 170^\circ, 4 \operatorname{cis} 290^\circ$

b)  $2 \operatorname{cis} 75^\circ, 2 \operatorname{cis} 150^\circ, 2 \operatorname{cis} 300^\circ$

c)  $2 \operatorname{cis} 40^\circ, 2 \operatorname{cis} 160^\circ, 2 \operatorname{cis} 280^\circ$

d)  $2 \operatorname{cis} 50^\circ, 2 \operatorname{cis} 170^\circ, 2 \operatorname{cis} 290^\circ$

**Word Problems -**

55. Distance - Two straight wires are strung on opposite sides of a tent pole and anchored to the ground by two stakes. One of the wires is 56 feet long and makes an angle of  $47^\circ$  with the ground. The other wire is 65 feet long and makes an angle of  $37^\circ$  with the ground. How far apart are the stakes that hold the wires to the ground?

- a) 97 feet                      b) 86 feet                      c) 80 feet                      d) 90 feet

56. Angle of Elevation/Height – To estimate the height of a tree, two people position themselves 25 feet apart. From the first person, the bearing of the tree is  $N 48^\circ E$  and the angle of elevation to the top of the tree is  $73^\circ$ . If the bearing of the tree from the second person is  $N 38^\circ W$ , find the height of the tree to the nearest foot.

- a) 50 feet                      b) 60 feet                      c) 65 feet                      d) 70 feet

57. Bearing & Distance - A boy is riding his motorcycle on a road that runs east and west. He leaves the road at a service station and rides 5.25 miles in the direction  $N 15.5^\circ E$ . Then he turns toward his right (do NOT assume  $90^\circ$ ) and rides 6.50 miles back to the road, where his motorcycle breaks down. How far will he have to walk to get back to the service station? What direction will he be walking in?

- a) 5.48 miles, W      b) 8.36 miles W      c) 8.36 miles, E      d) 5.48 miles, E

58. True Course and Speed – A helicopter is flying at 90 mph on a heading of  $40^\circ$ . A 20 mph wind is blowing from the NE on a heading of  $190^\circ$ . What is the true course and speed of the helicopter relative to the ground?

- a) 73 mph, Bearing  $7.8^\circ$                       b) 70 mph, Bearing  $150^\circ$   
c) 73 mph, Bearing  $47.8^\circ$                       d) 70 mph, Bearing  $50^\circ$

## ANSWER KEY

1. c
2. d
3. b
4. c
5. a
6. c
7. d
8. c
9. a
10. b
11. a
12. a
13. b
14. b
15. c
16. d
17. a
18. d
19. a
20. b

21. c
22. a
23. d
24. a
25. b
26. a
27. d
28. b
29. b
30. c
31. a
32. d
33. b
34. a
35. c
36. d
37. b
38. d
39. c
40. a

41. a
42. b
43. c
44. d
45. b
46. d
47. a
48. c
49. b
50. d
51. c
52. a
53. b
54. d
55. d
56. c
57. a
58. c