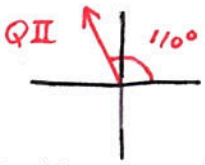
KC6 – Trigonometric functions
Review

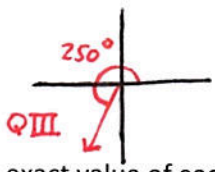
Name:_____
Date:_____

Problems 1-4. Draw the angle in standard form and state what quadrant it is in.

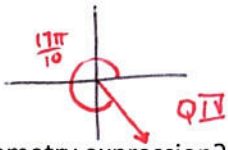
1. 110°



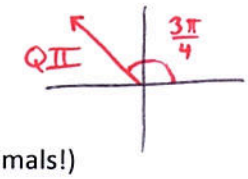
2. 250°



3. $\frac{17\pi}{10}$ ← Can convert to degrees →



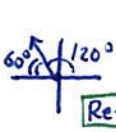
4. $\frac{3\pi}{4}$



Problems 5-8. What is the exact value of each trigonometry expression? (no decimals!)

Very easy if you know unit ⊙

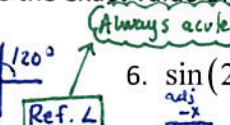
5. $\cos(120°)$



Always acute positive

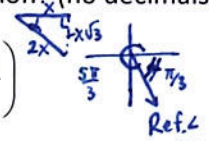
$\cos 120° = \frac{-x}{2x} = \frac{-1}{2}$

6. $\sin(225°)$



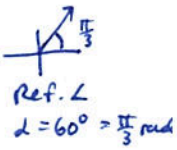
$\sin 225° = \frac{-x}{x\sqrt{2}} = \frac{-1}{\sqrt{2}} = \frac{-\sqrt{2}}{2}$

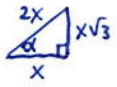
7. $\cos\left(\frac{5\pi}{3}\right)$



$\cos \frac{5\pi}{3} = \frac{x}{2x} = \frac{1}{2}$

8. $\sin\left(\frac{\pi}{3}\right)$

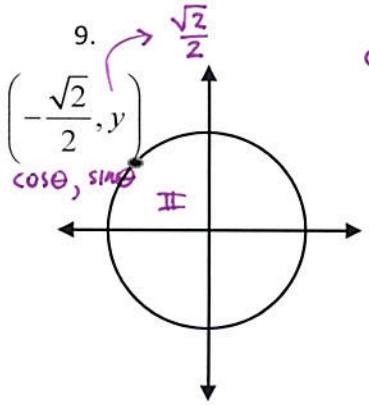




$\sin\left(\frac{\pi}{3}\right) = \frac{x\sqrt{3}}{2x} = \frac{\sqrt{3}}{2}$

Problems 9-10. Find the missing point such that the point is on the unit circle.

9. $\left(-\frac{\sqrt{2}}{2}, y\right)$



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

$\left(-\frac{\sqrt{2}}{2}\right)^2 + \sin^2\theta = 1$

$\frac{1}{2} + \sin^2\theta = 1$

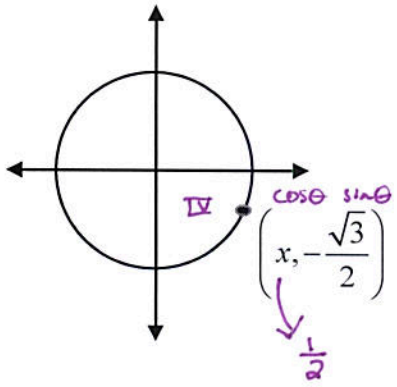
$\sin^2\theta = \frac{1}{2}$

$\sin\theta = \pm\sqrt{\frac{1}{2}} = \pm\frac{1}{\sqrt{2}} = \pm\frac{\sqrt{2}}{2}$

But in QII, $\sin\theta > 0$.

$\therefore y = \frac{\sqrt{2}}{2}$

10.



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

$\cos^2\theta + \left(-\frac{\sqrt{3}}{2}\right)^2 = 1$

$\cos^2\theta + \frac{3}{4} = 1$

$\cos^2\theta = \frac{1}{4}$

$\cos\theta = \pm\sqrt{\frac{1}{4}} = \pm\frac{1}{2}$

But in QIV, $\cos\theta > 0$.

$\therefore x = \frac{1}{2}$

Problem 11-12, Change to radians:

11. 260°

$260° \cdot \frac{\pi \text{ rad}}{180°} = \frac{260\pi \text{ rad}}{180} = \frac{13\pi \text{ rad}}{9}$ or $\frac{13\pi}{9}$

12. 85°

$85° \cdot \frac{\pi \text{ rad}}{180°} = \frac{17\pi \text{ rad}}{36}$ or $\frac{17\pi}{36}$

Problem 13-14, Change to degrees:

13. $\frac{\pi}{5}$

$\frac{\pi \text{ rad}}{5} \cdot \frac{180°}{\pi \text{ rad}} = \frac{180°}{5} = 36°$

14. $\frac{5\pi}{18}$

$\frac{5\pi \text{ rad}}{18} \cdot \frac{180°}{\pi \text{ rad}} = \frac{900°}{18} = 50°$

Problems 15-17. What is the exact value of each trigonometry expression? (no decimals!)

Know your unit ⊙ !

15. $\tan\left(\frac{11\pi}{6}\right)$

$\tan\left(\frac{11\pi}{6}\right) = \frac{\sin\left(\frac{11\pi}{6}\right)}{\cos\left(\frac{11\pi}{6}\right)} = \frac{-\frac{1}{2}}{\frac{\sqrt{3}}{2}} = -\frac{1}{2} \cdot \frac{2}{\sqrt{3}} = -\frac{1}{\sqrt{3}} = -\frac{\sqrt{3}}{3}$

16. $\tan\left(\frac{3\pi}{4}\right)$

$\tan\left(\frac{3\pi}{4}\right) = \frac{\sin\left(\frac{3\pi}{4}\right)}{\cos\left(\frac{3\pi}{4}\right)} = \frac{\frac{\sqrt{2}}{2}}{-\frac{\sqrt{2}}{2}} = -1$

17. $\tan\left(\frac{4\pi}{3}\right)$

$\tan\left(\frac{4\pi}{3}\right) = \frac{\sin\left(\frac{4\pi}{3}\right)}{\cos\left(\frac{4\pi}{3}\right)} = \frac{-\frac{\sqrt{3}}{2}}{-\frac{1}{2}} = \frac{\sqrt{3}}{2} \cdot \frac{2}{1} = \sqrt{3}$

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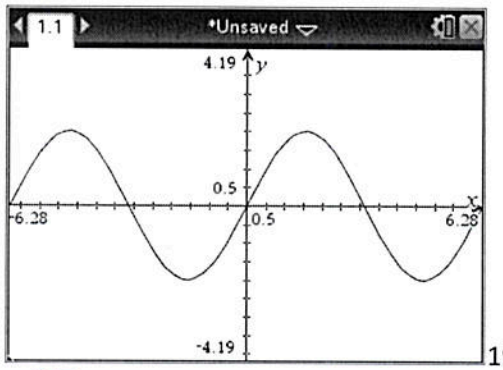
Given the following equation and graph, find the period and amplitude of each function.

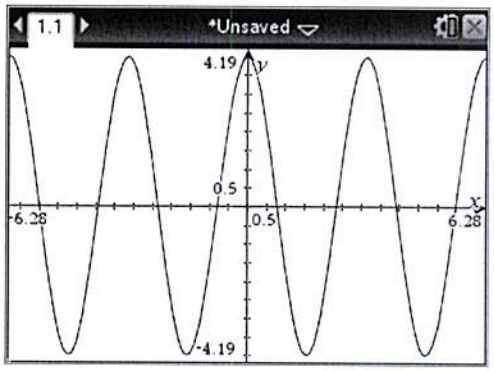
18. $y = 2\sin(\theta)$ $a = 2$, $b = 1$



Period: $\frac{2\pi}{|b|} = \frac{2\pi}{1} = 2\pi$

Amplitude: $|a| = |2| = 2$

19. $y = 4\cos(2\theta)$ $a = 4$, $b = 2$

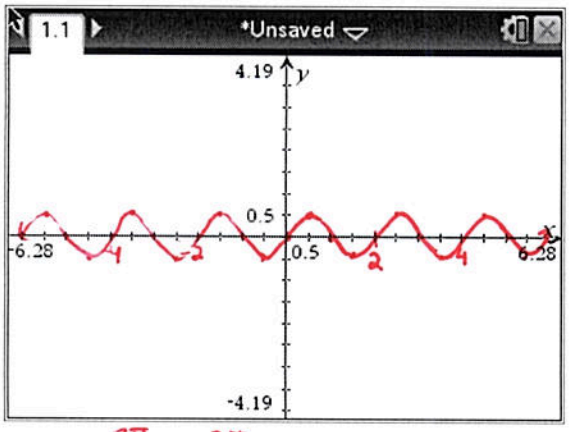


Period: $\frac{2\pi}{|b|} = \frac{2\pi}{|2|} = \frac{2\pi}{2} = \pi$

Amplitude: $|a| = |4| = 4$

Graph the following equation, and find the period and amplitude of each function.

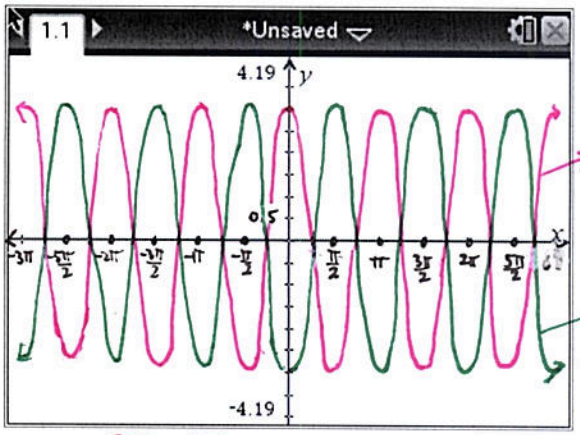
20. $y = \frac{1}{2}\sin(\pi\theta)$ $a = \frac{1}{2}$, $b = \pi$



Period: $\frac{2\pi}{|b|} = \frac{2\pi}{\pi} = 2$

Amplitude: $|a| = |\frac{1}{2}| = \frac{1}{2}$

21. $y = -3\cos(2\theta)$ $a = -3$, $b = 2$



Period: $\frac{2\pi}{|b|} = \frac{2\pi}{2} = \pi$

Amplitude: $|a| = |-3| = 3$

22. Find $cos(\theta)$ given $sin(\theta) = \frac{\sqrt{3}}{2}$ in Quadrant II.

$\cos(\theta) = -\frac{1}{2}$ -OR-

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

$\cos^2\theta + \left(\frac{\sqrt{3}}{2}\right)^2 = 1$

$\cos^2\theta + \frac{3}{4} = 1$

$\cos^2\theta = \frac{1}{4}$

$\cos\theta = \pm\sqrt{\frac{1}{4}}$, QII

$\therefore \cos\theta = -\frac{1}{2}$

23. Find $sin(\theta)$ given $cos(\theta) = -\frac{\sqrt{2}}{2}$ in Quadrant II.

Know unit ⊙? Easy!

$\sin\theta = \frac{\sqrt{2}}{2}$ -OR-

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

$\left(-\frac{\sqrt{2}}{2}\right)^2 + \sin^2\theta = 1$

$\frac{1}{2} + \sin^2\theta = 1$

$\sin^2\theta = \frac{1}{2} \Rightarrow \sin\theta = \pm\frac{1}{\sqrt{2}} = \pm\frac{\sqrt{2}}{2}$, QII

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24. Find $tan(\theta)$ given $sin(\theta) = \frac{4}{5}$ in Quadrant I.

opp/hyp

(3, 4, 5)

(+, +) I

hyp 5, 4 opp, 3 adj, θ

$\tan\theta = \frac{4}{3}$

25. Find $cos(\theta)$ given $sin(\theta) = -\frac{3}{5}$ in Quadrant III.

(3, 4, 5)

(−, −) III

−4, −3, 5, θ

$\cos\theta = \frac{-4}{5}$

26. If $tan(\theta)$ is positive, what quadrant would θ be in if $cos(\theta)$ is also positive?

ALL STUDENTS TAKE CALCULUS

Tanθ + Cosθ + | Tanθ + Cosθ +

QI

27. If $sin(\theta)$ is negative, what quadrant would θ be in if $tan(\theta)$ is positive?

tanθ +

sinθ − tanθ + | sinθ

QIII

28. What is $sin(\theta)$ for an angle θ in standard position whose terminal side contains the point (4, 3)?

hyp 5, P(4,3) x y, 3 opp, 4 adj

$\sin\theta = \frac{3}{5}$

29. What is $tan(\theta)$ for an angle θ in standard position whose terminal side contains the point (-28, 45)?

$r = \sqrt{(-28)^2 + (45)^2} = 53$

P(−28, 45) x y, hyp 53, opp 45, −28 adj

$\tan\theta = -\frac{45}{28}$

30. Find the exact value of $sin(\theta)$ if the terminal side of θ in standard position contains the given point (0,1).

x y

x = 0

y = 1

P(0,1) x y

$r = \sqrt{(0)^2 + (1)^2} = 1$

"Think like" → r, θ, y, x

$\sin\theta = \frac{y}{r} = \frac{1}{1} = 1$

∴ sinθ = 1 or just think unit ⊙ here

31. Find the exact value of $cos(\theta)$ if the terminal side of θ in standard position contains the given point (0,-6).

x y

x = 0

y = −6

x y (0, −6)

$r = \sqrt{0^2 + (-6)^2} = 6$

"Think like" → r, θ, y, x

$\cos\theta = \frac{x}{r} = \frac{0}{6} = 0$

32. Suppose in between low and high tides, the water level varies 108 inches. Low tide occurs at 6am and high tide is at 9pm. Using the times and the amount the water level varies find a cosine function that models the water level in inches above and below the average water level. Express the function in terms of time, in hours since 6:00 A.M.

f(x) = a cos bx

high / low

Amp: $\frac{1}{2}(108) = 54$ but $a = -54$ since we begin at low tide.

Time between 6am to 9pm is 15 hrs, half cycle. So full cycle is 30 hrs.

$\frac{2\pi}{b} = 30 \Rightarrow 2\pi = 30b \Rightarrow b = \frac{2\pi}{30} = \frac{\pi}{15}$

$\therefore f(t) = -54\cos\left(\frac{\pi}{15}t\right)$ models water level.