

Show all your work if you want to receive credit.

1. Find all radian solutions to $4 \cos\left(2t - \frac{\pi}{6}\right) + 4 = 2$. Use exact values.
2. Find all radian solutions to $\sin 2x + \sin x = 0$. Use exact values.
3. Find all degree solutions on the interval $0 \leq x \leq 360^\circ$ for $6 \tan^2 x + \tan x - 1 = 0$. Use decimals accurate to one place to the right of the decimal point.

4. Using the identities

$$A \cos x + B \sin x = C \cos(x - \phi) \text{ where } C = \sqrt{A^2 + B^2}, \cos \phi = \frac{A}{C}, \text{ and } \sin \phi = \frac{B}{C}$$

and

$$A \cos x + B \sin x = C \sin(x + \phi) \text{ where } C = \sqrt{A^2 + B^2}, \cos \phi = \frac{B}{C}, \text{ and } \sin \phi = \frac{A}{C}$$

- (a) Write $-5 \cos x + 12 \sin x$ in the form $C \cos(x - \phi)$. The value of ϕ should be in radians.
 - (b) Write $-5 \cos x + 12 \sin x$ in the form $C \sin(x + \phi)$. The value of ϕ should be in radians.
5. Find the exact value of $\sin\left(\arccos \frac{a}{b}\right)$. Assume $0 < a < b$.
 6. Sketch two periods of $y = \tan \frac{\pi x}{4}$. Be sure to label the asymptotes.
 7. Assume that the high tides can be described by a sine wave on a 28 day period. At the beginning of the month ($t = 0$), the high tide reach 4 foot on a vertical wall. This is the lowest high tide of the month. Halfway through the month, the high tides reach 8 feet on the vertical wall. This is the highest high tide of the month. Write the sine function that models this data.
 8. The earth is approximately 292,000,000 miles from the sun and makes an orbit in one year. Assuming that the orbit forms a circle, find the speed of the earth as it moves around the sun. The answer should be in miles per hour.
 9. The front gear of a bicycle has radius of 4 inches and the back gear has a radius of 2 inches. The radius of the back wheel is 14 inches. If the front gear rotates at 70 revolutions per minute, find the speed of the bicycle in miles per hour. Note that 1 mile = 5280 feet.
 10. Two buildings are separated by 100 feet horizontally. The building are on level ground. The angle of elevation from the top of Building A to the top of Building B is 37° . The angle of depression from the top of Building A to the bottom of Building B is 18° . How tall is Building B?
 11. A boy is standing near a large wall. On the wall there is a picture of a puppy. When the boy looks at the bottom of the puppy, the angle of elevation is 21° . When the boy looks at the top of the puppy, the angle of elevation is 37° . If the bottom of the puppy is 25 feet from the ground, how far from the ground is the top of the puppy? Assume the ground is level, the wall is vertical, and the boy's eyes are three feet above the ground.