

Trigonometric Functions and the Unit Circle: math test solutions, Grade 11 – download the PDF

Test solutions with the detailed point scale. Add up your points and spot what to review.

Suggested time: 45 minutes. Out of 20 points. Calculator allowed only when the problem says so.

1 Radians and degrees

/ 3 pts

- a. $72 \times \frac{\pi}{180} = \frac{2\pi}{5}$. (1 pt)
- b. $\frac{5\pi}{12} \times \frac{180}{\pi} = 75^\circ$. (1 pt)
- c. $\frac{7\pi}{9} \times \frac{180}{\pi} = 140^\circ$. (1 pt)

2 Exact values

/ 4 pts

- a. Quadrant II, reference angle $\frac{\pi}{3}$, sine positive: $\frac{\sqrt{3}}{2}$. (1 pt)
- b. Quadrant III, reference angle $\frac{\pi}{6}$, cosine negative: $-\frac{\sqrt{3}}{2}$. (1 pt)
- c. Quadrant III, reference angle $\frac{\pi}{4}$, tangent positive: **1**. (1 pt)
- d. The angle is in quadrant IV with reference angle $\frac{\pi}{6}$, sine negative: $-\frac{1}{2}$. (1 pt)

3 Using the identity

/ 3 pts

a. $\cos^2 \theta = 1 - \frac{64}{289} = \frac{225}{289}$, so $\cos \theta = \pm \frac{15}{17}$ (1 pt). Cosine is negative in quadrant III, so $\cos \theta = -\frac{15}{17}$ (1 pt).

b. $\tan \theta = \frac{-8/17}{-15/17} = \frac{8}{15}$ (1 pt).

4 Reading a sinusoid

/ 3 pts

a. $4x - \pi = 4\left(x - \frac{\pi}{4}\right)$, so $y = 2 \sin\left(4\left(x - \frac{\pi}{4}\right)\right) + 3$ (1 pt, with the factoring shown).

b. Amplitude 2, period $\frac{2\pi}{4} = \frac{\pi}{2}$, phase shift $\frac{\pi}{4}$ to the right, midline $y = 3$ (1 pt for all four values).

c. Maximum $3 + 2 = 5$, minimum $3 - 2 = 1$ (1 pt).

5 Equations

/ 3 pts

a. $\sin x = \frac{\sqrt{3}}{2}$, reference angle $\frac{\pi}{3}$, quadrants I and II: $x = \frac{\pi}{3}$ or $x = \frac{2\pi}{3}$. (1 pt)

b. Factor: $(2 \cos x - 1)(\cos x + 1) = 0$ (1 pt). Then $\cos x = \frac{1}{2}$ gives $x = \frac{\pi}{3}, \frac{5\pi}{3}$, and $\cos x = -1$ gives $x = \pi$ (1 pt for the three solutions).

6 A floating buoy

/ 4 pts

- a. Period $\frac{2\pi}{\pi/5} = 10$ seconds; maximum $2 + 1.5 = 3.5$ m; minimum $2 - 1.5 = 0.5$ m. (1 pt)
- b. $h(2.5) = 2 + 1.5 \sin \frac{\pi}{2} = 3.5$ m. (1 pt)
- c. $1.5 \sin \frac{\pi t}{5} = 0$, so $\frac{\pi t}{5} = 0, \pi, 2\pi$ and $t = 0, 5, 10$ seconds. (1 pt)
- d. $3.5 \div 0.3048 \approx 11.48$ ft. (1 pt)



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