

Trigonometric Functions and the Unit Circle: math test solutions, Grade 12 – 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 arcs

/ 4 pts

a) $210 \cdot \frac{\pi}{180} = \frac{7\pi}{6}$ (1 pt)

b) $\frac{11 \cdot 180}{4} = 495^\circ$ (1 pt)

c) $s = 9 \cdot \frac{2\pi}{3} = 6\pi \approx 18.85 \text{ in}$ (1 pt)

d) $A = \frac{1}{2} \cdot 81 \cdot \frac{2\pi}{3} = 27\pi \approx 84.82 \text{ in}^2$ (1 pt)

2 Exact values

/ 4 pts

a) Quadrant IV, reference $\frac{\pi}{3}$: $-\frac{\sqrt{3}}{2}$ (1 pt)

b) Quadrant II, reference $\frac{\pi}{4}$: $-\frac{\sqrt{2}}{2}$ (1 pt)

c) Quadrant III, reference $\frac{\pi}{6}$, tangent positive: $\frac{\sqrt{3}}{3}$ (1 pt)

d) $\cos \frac{11\pi}{6} = \frac{\sqrt{3}}{2}$, so $\sec = \frac{2}{\sqrt{3}} = \frac{2\sqrt{3}}{3}$ (1 pt)

3 Using the Pythagorean identity

/ 3 pts

$\sin^2 \theta = 1 - \frac{64}{289} = \frac{225}{289}$; in quadrant III sine is negative, so $\sin \theta = -\frac{15}{17}$ (1 pt).

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

$\csc \theta = -\frac{17}{15}$ (1 pt).

4 A ladder (calculator allowed)

/ 3 pts

Sketch with the ladder as hypotenuse (1 pt).

Height = $4.5 \sin 64^\circ \approx 4.04$ m (1 pt).

Distance = $4.5 \cos 64^\circ \approx 1.97$ m (1 pt).

5 Solving an equation

/ 3 pts

$\cos \theta = -\frac{1}{2}$ (1 pt). The reference angle is $\frac{\pi}{3}$ and cosine is negative in quadrants II and III.

$\theta = \frac{2\pi}{3}$ (1 pt) or $\theta = \frac{4\pi}{3}$ (1 pt).

6

Wind turbine (calculator allowed)

/ 3 pts

$$\omega = 15 \cdot 2\pi = 30\pi \approx 94.2 \text{ rad/min (1 pt).}$$

$$v = 120 \cdot 30\pi = 3600\pi \approx 11,309.7 \text{ ft/min (1 pt).}$$

$$11,309.7 \cdot \frac{60}{5280} \approx 128.5 \text{ mph (1 pt).}$$

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