Hon Pre Calculus
Quiz 4.5   Name _____
Sinusoidal Modeling

No Calculators!! Circle All Final Answers!! All answers in Exact Values!! Label!! (20 Points)

1. _**Extraterrestrial Being**_: Researchers find a creature from an alien planet. The alien's body temperature varies sinusoidally with time. Two minutes after researchers start timing the alien's temperature it reaches a maximum high of 140°F. Six minutes later it reaches its lowest point of -20°F.

   1) Sketch one cycle of the graph of the Alien's temperature over the appropriate period of time.

   Graph

   2) Write an equation that models this situation.

3) What is the temperature of the alien when the researchers started timing?

4) Predict the alien's **EXACT** temperature at:

   a) 18 minutes

   b) 12 minutes 30 seconds

5) What is the first time the Alien's body temperature reaches $\left(-40\sqrt{3}+60\right)°$?

Name _____ $\frac{22}{40}$

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1. ***Extraterrestrial Being***: Researchers find a creature from an alien planet. The alien's body temperature varies sinusoidally with time. Two minutes after researchers start timing the alien's temperature it reaches a maximum high of 140°F. Six minutes later it reaches its lowest point of -20°F.

   amp: 80 $b = \frac{2\pi}{12} = \pi/6$ $k = 60$
   per: 12 $h = 2$

   1) Sketch one cycle of the graph of the Alien's temperature over the appropriate period of time.
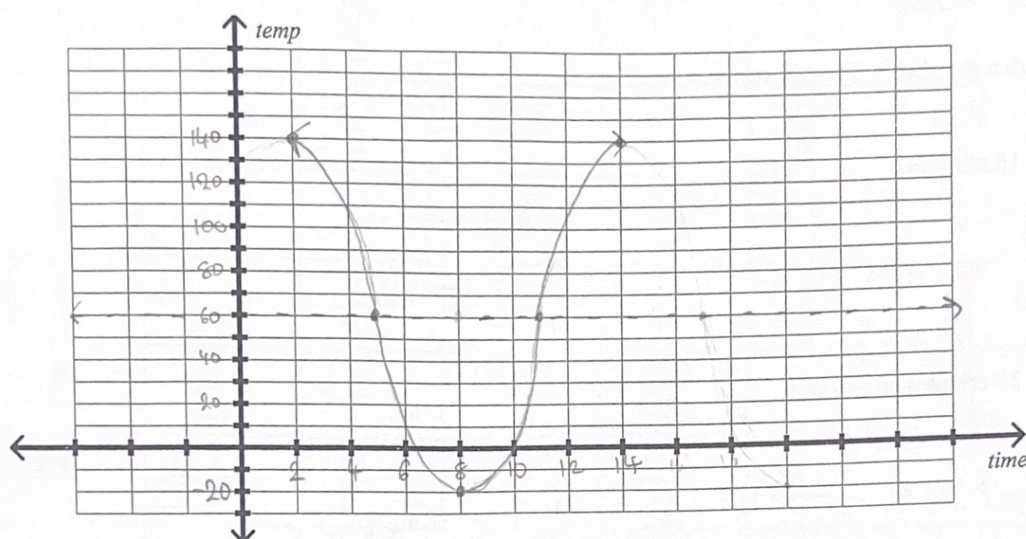
   2) Write an equation that models this situation.

   $$y = 80\cos\left(\frac{\pi}{6}(t - 2)\right) + 60$$

3) What is the temperature of the alien when the researchers started timing?

$$y = 80\cos\left(\tfrac{\pi}{6}(7-2)\right) + 60 \qquad y = 80\left(\tfrac{1}{2}\right) + 60$$

$$y = 80\cos\left(\tfrac{\pi}{6}(-2)\right) + 60 \qquad y = 40 + 60$$

$$y = 80\cos\left(-\tfrac{2\pi}{6}\right) + 60 \qquad y = 100$$

$$y = 80\cos\left(-\tfrac{\pi}{3}\right) + 60$$

$$\boxed{100°F}$$

4) Predict the alien's **EXACT** temperature at:

$$\tfrac{8\pi}{3} = \tfrac{2\pi}{3}$$

a) 18 minutes

$$y = 80\cos\left(\tfrac{\pi}{6}(18-2)\right) + 60 \qquad y = 80\left(-\tfrac{1}{2}\right) + 60$$

$$y = 80\cos\left(\tfrac{16\pi}{6}\right) + 60 \qquad y = -40 + 60$$

$$y = 80\cos\left(\tfrac{8\pi}{3}\right) + 60 \qquad y = 20$$

$$\boxed{20°F}$$

b) 12 minutes 30 seconds

$$y = 80\cos\left(\tfrac{\pi}{6}(12.5-2)\right) + 60 \qquad y = 80\left(\tfrac{\sqrt{2}}{2}\right) + 60$$

$$y = 80\cos\left(\tfrac{10.5\pi}{6}\right) + 60 \qquad y = 40\sqrt{2} + 60$$

$$y = 80\cos\left(\tfrac{21\pi}{12}\right) + 60$$

$$y = 80\cos\left(\tfrac{7\pi}{4}\right) + 60$$

$$\boxed{40\sqrt{2} + 60 \ °F}$$

5) What is the first time the Alien's body temperature reaches $\left(-40\sqrt{3}+60\right)°$?

$$-40\sqrt{3} + 60 = 80\cos\left(\tfrac{\pi}{6}(7-2)\right) + 60 \qquad y = 80\cos\left(\tfrac{\pi}{6}(7-2)\right) + 60$$

$$-40\sqrt{3} \qquad = 80\cos\left(\tfrac{\pi}{6}(7-2)\right) \qquad y = 80\cos\left(\tfrac{5\pi}{6}\right) + 60$$

$$-\tfrac{\sqrt{3}}{2} = \cos\left(\tfrac{\pi}{6}(7-2)\right) \qquad y = 80\left(-\tfrac{\sqrt{3}}{2}\right) + 60$$

$$y = -40\sqrt{3} + 60$$

$$\cos\tfrac{5\pi}{6} = -\tfrac{\sqrt{3}}{2}$$

$$\tfrac{\pi}{6}7 - \tfrac{2\pi}{6} = \tfrac{5\pi}{6} \qquad \tfrac{7\pi}{6} \times \tfrac{6}{\pi} = 7$$

$$\tfrac{\pi}{6}7 = \tfrac{7\pi}{6} \qquad \boxed{7 \text{ minutes}}$$

$$7 = 7$$

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