## Additional Review Problems for Quiz 2

The following problems are provided to help you practice the skills involved in setting up and using functions based on sine or cosine.

1. The graph (below) shows the percentage of high school seniors who had tried some kind of illicit drug at least once. The graph covers high school seniors in 1975 through to high school seniors in 1997.
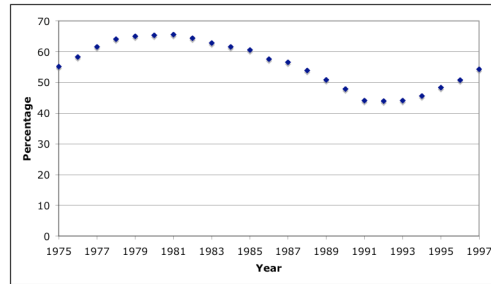
In 1975, 55% of high school seniors had tried drugs. In 1981 the percentage reached a peak of 66%. In 1992, the percentage reached a low of 44%. By 1997, the percentage was back to about 55%.

(a) The function $P(x)$ gives the percentage who had tried drugs at least once as a function of x, the number of years since 1975. You can assume that $P(x)$ is a trigonometric function. Find a formula for $P(x)$.

(b) According to the formula that you found in Part (a), what percentage of high school seniors from 2008 tried drugs at least once?

(c) According to the formula that you found for $P(x)$, what is the first year *after* 2008 in which the percentage of high school seniors who have tried drugs will rise to 66%?

2. Find a formula for the function graphed below. (You can assume that it is a trigonometric function.
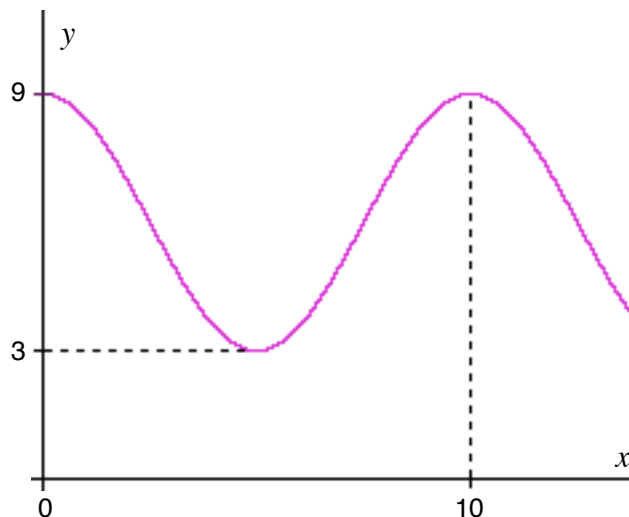
3. The USS Michigan is a ballistic missile submarine in the US Navy. This submarine is driven by a large, circular propeller that has a radius of 10 feet. When the submarine is holding a stationary position underwater, the center of the propeller is 80 feet below the surface of the sea, and the propeller turns very slowly, making one complete revolution every 4 minutes.

A barnacle is a small sea creature that attaches itself to surfaces like propellers. At time $t = 0$, a barnacle attaches itself to the outer tip of a propeller blade in the "6 o'clock" position. The function $D(t)$ gives the depth of the barnacle below the surface of the sea t minutes after attaching itself to the propeller.

(a) Sketch a graph of $y = D(t)$ for $0 \leq t \leq 8$. Make sure that you put appropriate scales on **both** axes.

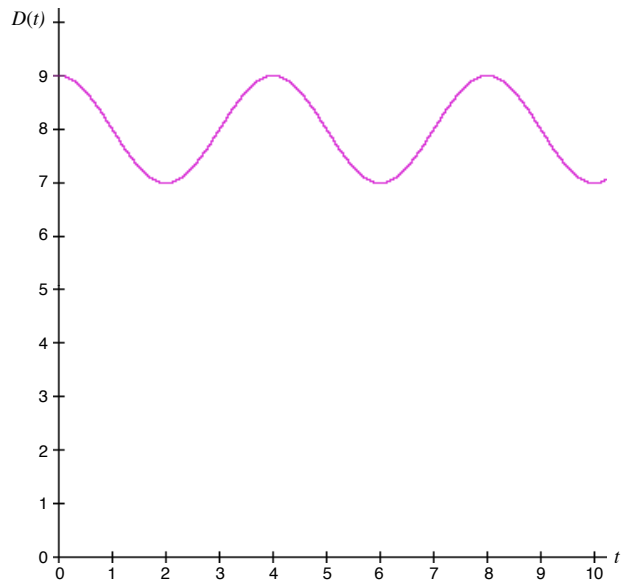**(b)** Write down a formula for $D(t)$.

Answers:

1.(a) $P(x) = 11 \cdot \sin\left(\frac{2\pi}{22} \cdot x\right) + 55$

1.(b) 55%.

1.(c) The year 2023, 2024 or 2025, depending on how you round.

2. $y = 3 \cdot \cos\left(\frac{2\pi}{10} x\right) + 6$

3.(a) The graph of $D(t)$ versus t is shown below.

3.(b) $D(t) = 10 \cdot \cos\left(\frac{2\pi}{4} t\right) + 80$