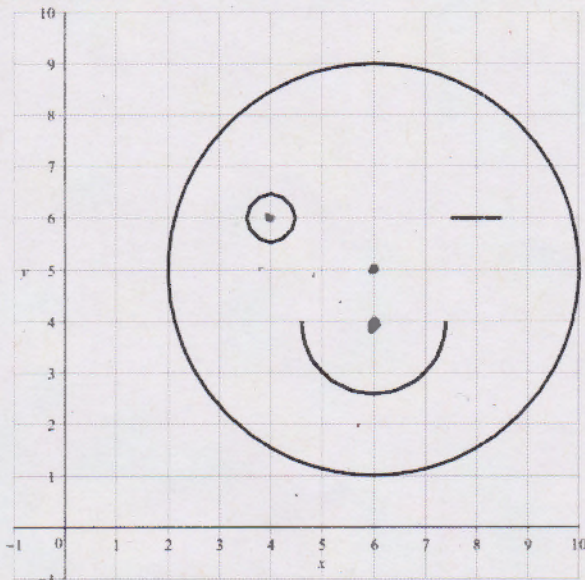


Solutions

Name and Section \_\_\_\_\_

Draw this winking face using parametric equations where the parameter  $t$  is time in seconds. You can draw at a speed of  $\pi$  inches per second. You have to figure out at what  $t$  each will end with your speed of  $\pi$  inches per second and the length of the curve you will trace. The face is made up of circles, a half circle and a horizontal line.



1. Head. Start drawing at the rightmost point  $t = 0$ .

center (6,5)  $r=4$   
 $x(t) = 6 + 4 \cos\left(\frac{2\pi}{8}t\right)$      $y(t) = 5 + 4 \sin\left(\frac{2\pi}{8}t\right)$      $0 \leq t \leq 8$

circumference  $8\pi$   
 8 seconds to finish  
 $w = \frac{2\pi}{8}$

2. Mouth: This is not a complete circle! Draw counterclockwise starting at the leftmost point at  $t = 0$ .

$x(t) = 6 + 1.5 \cos\left(\frac{\pi}{1.5} + \frac{2\pi}{3}t\right)$      $y(t) = 4 + 1.5 \sin\left(\frac{\pi}{1.5} + \frac{2\pi}{3}t\right)$      $0 \leq t \leq 1.5$

circumference  $3\pi$   
 1.5s to finish  
 $w = \frac{2\pi}{3}$

3. Eye on the left. Start drawing at the top at  $t = 0$ . You have to approximate the radii of the eye.

$x(t) = 4 + 0.5 \cos\left(\frac{\pi}{2} + 2\pi t\right)$      $y(t) = 6 + 0.5 \sin\left(\frac{\pi}{2} + 2\pi t\right)$      $0 \leq t \leq 1$

circumference  $\pi$   
 1 second to finish  
 $w = 2\pi$

4. Eye on the right. Start drawing at the leftmost point at  $t = 0$ .

$x(t) = 7.5 + \pi t$      $y(t) = 6$

$0 \leq t \leq \frac{1}{\pi}$

length = 1 at  $\pi$  m/s

so line head in  $\frac{1}{\pi}$  seconds.