

## MATH 1710 Tutorial 11

In problems 1–4, draw the curve.

1.  $x = 2t - 5, \quad y = 3 - t, \quad 0 \leq t \leq 1$

2.  $x = 5 - t, \quad y = t^2 + 2, \quad 1 \leq t \leq 2$

3.  $x = 3 + 2 \cos t, \quad y = -2 + 3 \sin t, \quad 0 \leq t \leq \pi$

4.  $x = 2 \cos t, \quad y = 3 \sin 2t, \quad 0 \leq t \leq 2\pi$

In problems 5–7, find the first and second derivatives of any functions defined by the parametric equations.

5.  $x = t^3 - 4t, \quad y = t^2 + 3$

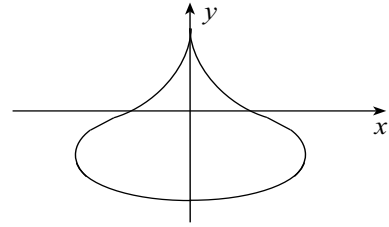
6.  $x = t - \cos 2t, \quad y = 3 + \sin 4t$

7.  $x = 1 + e^t, \quad y = 2 - e^{3t}$

8. The droplet in the figure to the right has parametric equations

$$x = 2 \cos t - \sin 2t, \quad y = \sin t,$$

for  $0 \leq t \leq 2\pi$ .



(a) Find its  $x$ - and  $y$ -intercepts.

(b) Verify that the slope of the curve is zero at its negative  $y$ -intercept.

(c) Verify that the slope of the curve is undefined at its positive  $y$ -intercept.

Does the curve appear to have a tangent line at this point?

(d) Find the coordinates of the rightmost point on the curve.

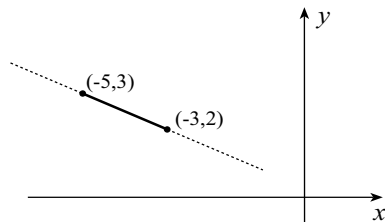
9.(a) Draw the curve  $x = t^2 + 1, \quad y = t(t - 1)^2, \quad -1 \leq t \leq 2$ .

(b) Find points on the curve where the tangent line is horizontal.

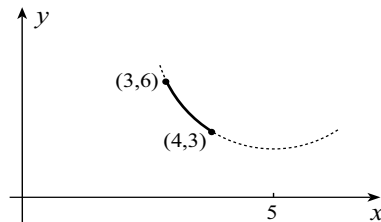
(c) Find the  $x$ -coordinates of any points on the curve at which the slope of the tangent line is equal to 1.

### Answers

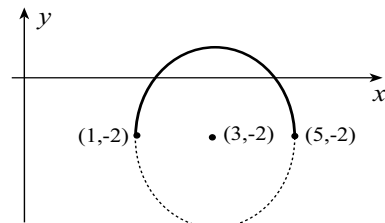
1.



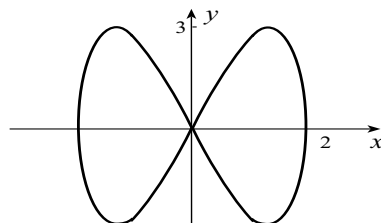
2.



3.



4.



5.  $\frac{2t}{3t^2 - 4}, \quad -\frac{6t^2 + 8}{(3t^2 - 4)^3}$

6.  $\frac{4 \cos 4t}{1 + 2 \sin 2t}, -\frac{16(\sin 4t + 2 \sin 2t \sin 4t + \cos 4t \cos 2t)}{(1 + 2 \sin 2t)^3}$

7.  $-3e^{2t}, -6e^t$

8.(a)  $\pm 2, \pm 1$  (c) Yes (d)  $(3\sqrt{3}/2, -1/2)$

9.(a)

(b)  $(2, 0), (10/9, 4/27)$

(c)  $2(4 \pm \sqrt{6})/3$

