Equations of Tangent and Normal Lines

Directions: Find the tangent and/or normal lines. Or do whatever else it says to do.

1. Find an equation of the tangent line to the curve $y = \frac{x}{1+x^2}$ at $x = 3$.

2. Find an equation of the tangent line to each of the following curves:

a. $y = \frac{2x}{x+1}$ at $x = 1$

b. $y = x + \sqrt{x}$ at $x = 4$

c. $y = (1 + 2x)^2$ at $x = 2$

3. Show that the curve $y = 6x^3 + 5x - 3$ has no tangent line with slope 4.

4. Find equations of the tangent and normal lines to the graph of the function at the given point, P. Then, find all x values for which the tangent line is horizontal.

a. $y = (2x - 1)^{10}$; $P(1,1)$

b. $y = \sqrt{2x^2 + 1}$; $P\left(-1, \sqrt{3}\right)$

5. Find equations of the tangent and normal lines to the graph of the equation $y = 2x + \cos(4x)$ at the point, $(0,1)$. Then, find all x values for which the tangent line is horizontal on $[0,2\pi)$.

6. Find an equation to the tangent line to the graph of $y = x^2 + \ln(2x - 5)$ at $x = 3$.

7. At what point on the graph of $y = 2e^x - 1$ is the tangent line perpendicular to the line $y = -3x + 2$

8. Find an equation of the tangent line to the graph of $y = x + \ln(x)$ that is perpendicular to the line whose equation is $2x + 6y = 5$.

9. The curve with the equation $y^2 = 5x^4 - x^2$ is called a *Kampyle of Eudoxus*. Find an equation of the tangent line to this curve at the point $(1,2)$.

10. At how many different x-coordinates might the "bouncing wagon" curve have a horizontal tangent line? What are those potential x-coordinates? You do not need to determine the actual coordinate pairs where the horizontal tangent lines occur.

$$2y^3 + y^2 - y^5 = x^4 - 2x^3 + x^2$$

11. Where does the normal line to the ellipse $x^2 - xy + y^2 = 3$ at the point $(-1,1)$ intersect the ellipse a second time?