Calculus 1 Worksheet #11
Equations of Tangent and Normal Lines

Learn: Tangent and Normal Curves
Remember: A derivative = slope of the Tangent line at that points x-coordinate
Example:

$f(x) = x^2 + 3$ pt(1, 4), $f'(x) = 2x \Rightarrow f'(1) = 2$

Tangent line: $y - 4 = 2(x-1) \Rightarrow y - 4 = 2x - 2 \Rightarrow y = 2x + 2$

Normal line: $y - 4 = -\frac{1}{2}(x-1) \Rightarrow y - 4 = -\frac{1}{2}x + \frac{1}{2} \Rightarrow y = -\frac{1}{2}x + \frac{9}{2}$

For the following:
1) Sketch a graph of f(x). Use Graph Paper !!!!!
2) Find slope at point p.
3) Find equation of tangent at point p. Sketch line.
4) Find equation of normal at point p. Sketch line.

1. $y = x^2 - 3$	p(2,1)	2. $y = 6 - x^2$	p(2,2)
3. $y = 4x - x^2$	p(2,4)	4. $y = x^2 - x - 6$	p(3,0)
5. $y = x^3 - x$	p(1,0)	6. $y = x^{1/2}$	p(4,2)
7. $y = 6x^{-1}$	p(3,2)	8. $y = x^3 - x$	p(–1,0)
9. $y = 2 - \sqrt{x}$	p(4,0)	10. $y = 4x^2 - x^4$	p($\sqrt{2}$,4)
11. $y = 2 - 4x^{-2}$	p(2,1)	12. $y = 1 + x^{2/3}$	p(0,1)

13 – 17, at the specified point, find the equation of the normal to the curve f(x) .

13. $f(x) = x^2$; (–3, _)
14. $f(x) = x^2 - x$; (1, _)
15. $f(x) = x^3$; (1,_)
16. $f(x) = x^{1/2}$, $x \geq 0$; (1,_)
17. $f(x) = 9x^{-1}$, $x \neq 0$; (3, _)

18. Use the **DEFINTION OF THE DERIVATIVE** to find f '(x) if f (x) = $x^3 + 2x$

Answers:

1. 4, $y = 4x - 7$, $y = -\frac{1}{4}x + \frac{3}{2}$	2. –4, $y = -4x + 10$, $y = \frac{1}{4}x + \frac{3}{2}$
3. 0, y = 4, x = 2	4. 5, $y = 5x - 15$, $y = -\frac{1}{5}x + \frac{3}{5}$
5. 2, $y = 2x - 2$, $y = -\frac{1}{2}x + \frac{1}{2}$	6. $\frac{1}{4}$, $y = \frac{1}{4}x + 1$, $y = -4x + 18$
7. $-\frac{2}{3}$, $y = -\frac{2}{3}x + 4$, $y = \frac{3}{2}x - \frac{5}{2}$	8. 2, $y = 2x + 2$, $y = -\frac{1}{2}x - \frac{1}{2}$
9. $-\frac{1}{4}$, $y = -\frac{1}{4}x + 1$, $y = 4x - 16$	10. 0, y = 4, $x = \sqrt{2}$
11. 1, $y = x - 1$, $y = -x + 3$	12. { }, none, none
13. $y = \frac{1}{6}x + \frac{19}{2}$	14. $y = -x + 1$
15. $y = \frac{-1}{3}x + \frac{4}{3}$	16. $y = -2x + 3$
17. $y = x$	18. $3x^2 + 2$

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