Implicit Differentiation

For problems 1 & 2 find $y'$.

1. $e^{x^2} - y^8 = x^4 \sin(10y)$

2. $e^{6y^3-x^2} = 8x + \cos(y)$

3. Find the equation of the tangent line to $\sin(x^2y^4) = 1 + 6y^3x^2$ at (-2, 0).

Related Rates

In order to receive any credit for problems 4 – 6 you MUST use Calculus techniques to find the answer. Any decimal work should include at least 4 decimal places.

4. A snowball in the shape of a sphere is melting in such a way that it is losing volume at a rate of 6 cm$^3$/sec. How fast is the radius of the snowball decreasing when the surface area of the snowball is $48\pi$ cm$^2$?

5. A tank of water in the shape of a cone is being filled at a rate of 3.5 ft$^3$/min. The tank is 10 ft tall and has a base radius of 32 ft. At what rate is the height of the water in the tank changing when the water is 3 ft deep?

6. Two boats start out 1500 miles apart with boat A directly to the west of boat B. At the same time both boats start moving with boat A traveling to the east at 30 mph while boat B travels north at 60 mph. Determine if the distance between the boats is increasing, decreasing or not changing after the following travel times.
   (a) 2 hours  (b) 10 hours  (c) 75 hours

Higher Order Derivatives

For problems 7 – 10 compute the second derivative.

7. $B(x) = \sqrt[3]{x^3} - \frac{1}{2x} + 9x$

8. $f(t) = \cos(4 + 3t) - 9e^{5t^2} \left(5t^2\right)$

9. $y = \ln\left(1 + e^{2x}\right)$

10. Compute $g^{(3)}(x)$ for $g(x) = \ln(15x^3) + e^{-4x} - \sin(3x)$