

PROBLEMS

1. Differentiate the following functions:

(a) $f(x) = 3 \cos(e^5) + \frac{\pi}{2}$

(b) $p(s) = s^5 - 2s^4 + 3s^3 - 4s^2 + 5s - 6$

(c) $f(t) = \frac{3t^2 - 5t + 1}{\sqrt{t}}$

(d) $g(x) = x^2 e^x - \frac{x^3}{\sqrt[4]{x}} + \frac{3}{x}$

(e) $q(y) = \frac{y^2 + y + 1}{y + 1}$

(f) $f(x) = \cos(4)(x^3 - 3x)$

(g) $g(x) = \frac{x^3 - 5}{\cos(-x)}$

(h) $h(x) = e^x \left(\frac{1}{\sqrt[4]{x^3}} + \frac{2}{x} \right)$

(i) $f(x) = \arcsin(\ln x)$

(j) $g(x) = 3e^{\sec 2x}$

(k) $h(x) = (x^2 + 1) \arctan x$

(l) $k(x) = \log_2(2x)$

2. Find the first five derivatives of

(a) $f(x) = e^{2x} + x^3$

(b) $g(x) = 27x^{4/3}$

3. Find the points where the tangent line to the graph of $f(x) = x^5 - 80x$ is horizontal.

4. Find an equation of the tangent line to $y = \sqrt{2x + 3}$ at $(3, 3)$.

5. Consider the curve given by $x^3y^3 - 3xy^3 + 4y = 6$.
- (a) Use implicit differentiation to find $y'(x)$.
 - (b) Check that the point $(2, 1)$ lies on this curve.
 - (c) What is the slope of the tangent line to this curve at $(2, 1)$?
6. Use logarithmic differentiation to find the derivative of
- (a) $f(x) = \frac{7(x+1)(x^2+2)^2}{(x^3+3)^3}$
 - (b) $g(x) = 10(\sin x)^{\cos x}(x^2-2)^3$
7. Find the linearization of $g(x) = \ln x$ at $x = 1$ and use it to approximate $\ln 1.13$.
8. A boy starts walking west at 6 km/h from a point P . Five minutes later a girl starts walking (a) north (b) east at 4 km/h from a point 15 km due south from P . At what rate is the distance between the kids changing 45 km after the girl starts moving? Is the distance increasing or decreasing at this instant?
9. A snowball is melting so that its radius is decreasing at a rate of 1 cm/min. Find the rate at which its volume is decreasing when the radius is 3 cm.