

Tutorials for end of Week 6 / beginning of Week 7

MATH1111: Introduction to Calculus

Semester 1, 2011

Web Page: <http://www.maths.usyd.edu.au/u/UG/JM/MATH1111/>

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1. Differentiate the following functions from first principles:

(a) $f(x) = 4$,

(b) $f(x) = 12x - 6$.

2. Differentiate the following polynomial functions:

(a) $y = x^{11}$

(b) $f(x) = 2x^2 - x + 1$

(c) $f(t) = t^3 - 4t^2 + 3t - 9$

(d) $y = x^2(x^2 - 1)$

(e) $g(t) = t^2 + t^{-2}$

(f) $h(x) = x^e + x^\pi$

3. Differentiate the following polynomial functions by first using index laws:

(a) $y = \frac{1}{x^2}$

(b) $f(x) = \sqrt[5]{x}$

(c) $h(x) = \sqrt{x}(x - 1)$

(d) $g(t) = 2t^3 - \frac{1}{t^2} + \sqrt{t}$

(e) $y = 4\sqrt{x^3} + \frac{2}{\sqrt{x}}$

(f) $h(t) = \frac{t^2 + t^3}{t^4}$

4. (a) Let $f(x) = -x^3 - 3x^2 + 9x + 10$.

(i) Find $f'(x)$ and $f''(x)$.

(ii) Find the values of x such that $f'(x) = 0$.

(iii) For each of the x -values found in part (ii), find the value of $f''(x)$.

(iv) Hence find the interval(s) on which $f'(x) \geq 0$.

(b) Let $f(x) = 2x^5 - 5x^2$. Find the interval(s) on which $f(x)$ is both increasing and concave up.

5. Differentiate the following functions:

(a) $y = 2e^x$

(b) $h(t) = 5(e^t + 2t^2 + t)$

(c) $g(x) = x^4 + 4e^x$

(d) $f(x) = 3x^3 + e^\pi$

6. Find the equation of the tangent line of each of the following functions at the given point:

(a) $f(x) = x^2 + 1$ at $(1, 2)$.

(b) $g(x) = 2x^3 + 2x + 3$ at $(1, 7)$.

(c) $h(x) = 2e^x$ at $(-0.5, 1.213)$.

7. Differentiate the following functions using the product rule:

(a) $f(x) = xe^x$

(b) $y = (2x^2 - 1)e^x$

(c) $g(t) = \sqrt{t} \cdot (e^t + 2)$

(d) $h(x) = 2x^2e^x + 6x$

8. Differentiate the following functions using the quotient rule:

(a) $y = \frac{x}{e^x}$

(b) $y = \frac{e^x}{x}$

(c) $f(x) = \frac{1+x^2}{1-x^2}$

(d) $g(t) = \frac{t^2+1}{\sqrt{t}}$

(e) $h(x) = \frac{2x^2}{3x^3-x}$

(f) $f(t) = \frac{t}{1+t}$

9. Find the first and second derivatives of the following functions:

(a) $f(x) = 4x^5 + 3x^4 - \frac{2}{x}$

(b) $y = x^3e^x$

(c) $h(t) = \frac{1+t^2}{t}$

(d) $g(x) = \frac{3e^x+1}{x}$

10. For each of the following functions, determine on what interval(s) the function is concave up.

(a) $h(t) = \frac{1+t^2}{t}$

(b) $g(x) = 4x^2 + 3x - 19$

(c) $y = e^x - x^2$