W5 – Differentiation Rules for Exponential Functions Unit 3
MCV4U
Jensen

1)a) Rewrite the function $y = b^x$ with base e.

b) Find the derivative of your function in part a) and simplify.

2) Differentiate with respect to x.

a) $y = e^{-3x}$

b) $f(x) = e^{4x-5}$

c) $y = e^{2x} - e^{-2x}$

d) $y = 2^x + 3^x$

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

f) $y = 4xe^x$

g) $y = 5^x e^{-x}$

h) $f(x) = xe^{2x} + 2e^{-3x}$

3) Determine the derivative with respect to x for each function.

a) $y = e^{-x} \sin x$

b) $y = e^{\cos x}$

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

d) $g(x) = 2x^2 e^{\cos(2x)}$

4) Identify the coordinates of any local extrema of the function $y = e^x - e^{2x}$

5) Find an equation for the tangent to the curve $y = 2e^{2x} + 2x + 1$ when $x = 0$.

6) Find the equation of the tangent to $y = x \ln x$ that is parallel to $y = 3x + 7$.

7) Find all local extrema for $y = \frac{1}{2}x(2)^{3x+1}$.

8) Continuous growth or decay follows the formula $A = ce^{kt}$, where *c* is the initial amount, and *k* is a rate factor. The mass of a radioactive substance is 1000 g on day 1, and only 100 g after 100 days. Find …

a) *k*, then write the equation with *c* and *k*

b) the half-life,

b) the amount that remains after 300 days, and

c) the rate of decay after 50 days.

Answers:

1)a) $y = e^{x \ln b}$ **b)** $\frac{dy}{dx} = \left(e^{x \ln b}\right) \ln b$
2)a) $y' = -3e^{-3x}$ **b)** $f'(x) = 4e^{4x-5}$ **c)** $y' = 2(e^{2x} + e^{-2x})$ **d)** $y' = 2^x(\ln 2) + 3^x(\ln 3)$
e) $f'(x) = 6e^{2x} - 3(2^{3x})\ln 2$ **f)** $y' = 4xe^x + 4e^x$ **g)** $y' = -(5^x)(e^{-x})(1 - \ln 5)$ **h)** $f'(x) = e^{2x}(2x + 1 - 6e^{-5x})$
3)a) $y' = e^{-x}(\cos x - \sin x)$ **b)** $y' = -\sin x\,(e^{\cos x})$ **c)** $f'(x) = e^{2x}(2x^2 - 4x + 1)$ **d)** $g'(x) = -4xe^{\cos(2x)}[x\sin(2x) - 1]$
4) local max of $y = 0.25$ when $x = \ln(0.5)$
5) $y = 6x + 3$
6) $y = 3x - e^2$
7) CN ~ -0.48, so the point (-0.48,-0.18) is a local minimum
8)a) *k* ~ -0.023, so the formula is $A = 1000e^{-0.023t}$
b) *t* ~ 30 days
c) $A(300) \approx 1g$
d) $A'(50) \approx -7.3g/day$