

**W4 – Derivatives of Exponential Functions**

Unit 3

MCV4U

Jensen

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

a)  $g(x) = 4^x$

b)  $f(x) = 11^x$

c)  $y = \left(\frac{1}{2}\right)^x$

d)  $N(x) = -3e^x$

e)  $h(x) = e^x$

f)  $y = \pi^x$

2) Find the first, second, and third derivatives of the function  $f(x) = e^x$

3) Calculate the instantaneous rate of change of the function  $y = 5^x$  when  $x = 2$ .

4) Determine the slope of the graph of  $y = \frac{1}{2}e^x$  at  $x = 4$ .

**5)** Determine the equation of the line that is tangent to  $y = 8^x$  at the point on the curve where  $x = \frac{1}{2}$ .

**6)** A fruit fly infestation is doubling every day. There are 10 flies when the infestation is first discovered.

**a)** Write an equation that relates the number of flies to time.

**b)** Determine the number of flies present after 1 week.

**c)** How fast is the fly population increasing after 1 week.

**d)** How long will it take for the fly population to reach 500?

**e)** How fast is the fly population increasing at this point?

7) Refer to question 6. At which point is the fly population increasing at a rate of

i) 20 flies per day?

ii) 2000 flies per day?

8) Determine the equation of the line perpendicular to the tangent line to the function  $f(x) = \frac{1}{2}e^x$  at the point on the curve where  $x = \ln 3$

**Answers:**

1)a)  $g'(x) = 4^x(\ln 4)$  b)  $f'(x) = 11^x(\ln 11)$  c)  $y' = \left(\frac{1}{2}\right)^x \left(\ln \frac{1}{2}\right)$  d)  $N'(x) = -3e^x$  e)  $h'(x) = e^x$  f)  $y' = \pi^x(\ln \pi)$

2)  $f'(x) = f''(x) = f'''(x) = e^x$

3) 40.2

4) 27.3

5)  $y = 6\sqrt{2}(\ln 2)x + \sqrt{2}(2 - 3 \ln 2)$

6)a)  $N(t) = 10(2)^t$  b) 1280 c) 887 flies/day d) 5.64 days e) 346 flies/day

7)i) 1.53 days ii) 8.17 days

8)  $y = -\frac{2}{3}x + \frac{2}{3}\ln 3 + \frac{3}{2}$