3.3 Derivatives of Exponential Functions Worksheet

This document was composed and formatted by Annie Bernatchez.

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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?

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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 $x = \ln 3$

Answer Key

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

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