Reference: Berresford, Sections 4.1, 4.2, 4.3, 4.4

1. (1 pt) Do the exponential expressions given below represent growth or decay?

- ? 1. $203(1.03)^t$
- ? 2. $0.22(0.04)^t$
- ? 3. $0.98(1.003)^t$
- ? 4. $109(.81)^t$
- ? 5. $42.7(0.92)^t$
- ? 6. $7.04(1.372)^t$

2. (1 pt) A travel mug of $91°C$ coffee is left on the roof of a parked car on a cold winter day. The temperature of the coffee after t minutes is given by $H = 91(2)^{-t/11}$. After how many minutes will the coffee be only lukewarm ($30°C$)?

$t =$ _____

3. (1 pt) What is the balance after 1 year of an account containing $900 which earns a yearly nominal interest of 6% that is compounded *(round all answers to the nearest cent; do not include commas)* :

(a) annually? $ _____
(b) weekly (there are 52 weeks per year)? $ _____
(c) every minute (there are 525,600 minutes per year)? $ _____
(d) continuously? $ _____

4. (1 pt) Rewrite each of the following as an expression of x which does not involve any logs.

(a) $\log_{10}(1000^x) =$ _____
(b) $100^{\log_{10}(x)} =$ _____
(c) $\log_{10}(0.01^x) =$ _____

5. (1 pt) Find the doubling time for a city whose population is growing by 15% per year.

The doubling time is _____ years.

6. (1 pt) Find the derivative of the function $y(x) = q^x + x^q$. Assume that q is a constant.

$y'(x) =$ _____

7. (1 pt) Since January 1, 1960, the population of Slim Chance has been described by the formula $P = 24000(0.96)^t$, where P is the population of the city t years after the start of 1960. At what rate was the population changing on January 1, 1987?

rate = _____ people/yr

8. (1 pt) Find the derivative of the function $f(x)$, below. It may be to your advantage to simplify first.

$f(x) = \dfrac{x^7}{8^x}$

$f'(x) =$ _____

9. (1 pt) Find the derivative of

$y = te^{-t^3}$
$\frac{dy}{dt} =$ _____

10. (1 pt) Find the derivative of

$y = \dfrac{e^{7x}}{x^2 + 1}$
$\frac{dy}{dx} =$ _____

11. (1 pt) Let

$$f(x) = 2x^8 \ln x$$

$f'(x) =$ _____

12. (1 pt) Let

$$f(x) = [\ln x]^5$$

Then $f'(x) =$ _____
and $f''(x) =$ _____

13. (1 pt) Demand for movie tickets to a certain theater depends on the ticket price p, in dollars, according to the demand function

$$D(p) = 120\sqrt{30 - p}.$$

Ticket price is currently set at 10 dollars. Find the elasticity of demand at the current ticket price.
$E(10) =$ _____

Find the ticket price which will maximize revenue.
Answer: _____ dollars

14. (1 pt) The concentration in miligrams per liter of a drug in a patient's blood t hours after being dosed is give by

$$c(t) = 12te^{-1.2t}.$$

How long will it take for the blood concentration of the drug to peak?
Answer: ___ hours
What is the peak concentration?
Answer: ___ mg/l