Homework 7 - Math 140   Name: _____

Due by 5:00pm Monday, April 19. Send a PDF with your solutions to `blins@hsc.edu`.

Use the linear approximation formula $L(x) = f(x_0) + f'(x_0)(x - x_0)$ to solve the following.

1. Find and simplify the linear approximation function for $f(x) = \sqrt[3]{x}$ at $x_0 = 8$.

2. Use the linear approximation from the last problem to estimate $\sqrt[3]{9}$.

3. Find and simplify the linear approximation function for $f(x) = \dfrac{20}{x}$ at $x_0 = 2$.

4. Use the tangent line from the last problem to estimate $\dfrac{20}{1.9}$.

Calculate the following derivatives.

5. $\dfrac{d}{dx} x^3 + e^x$

6. $\dfrac{d}{dy} y^5 e^y$

7. $\dfrac{d}{dx} e^{4x}$.

8. $\dfrac{d}{dx} \dfrac{e^x}{x}$.

9. $\dfrac{d}{dx} e^{-x^2}$.

10. $\dfrac{d}{du} (e^u + 1)^{-1}$.

Calculate the following logarithms

11. $\log_2(16)$

12. $\log_{10}(1000)$

13. $\log_3\left(\dfrac{1}{9}\right)$

14. $\log_{10}(0.001)$

15. $\log_5(5\sqrt{5})$

16. $\ln\left(\dfrac{1}{\sqrt{e}}\right)$

Use a calculator to solve the following equations for x (round answers to two decimal places).

17. $e^x = 5$.

18. $(1.05)^x = 3$

19. $500(1.01^x) = 600$

20. The price elasticity of demand is given by the formula $E = \left|\dfrac{pQ'}{Q}\right|$. Suppose that a business estimates that their customers will purchase $Q(p) = 400 - 10p$ items, when the price of each item is p dollars. What is the elasticity of demand when $p = \$10$? Is demand elastic or inelastic at that price?

21. A cup of hot water is set out to cool. Its temperature (in Fahrenheit) is $T(t) = 70 + 80e^{-0.1t}$ where t is the time since it was set out, in minutes. How long until the temperature of the cup reaches $90°$F?

22. Suppose you invest money in a bond that earns 1% interest (compounded annually) for 15 years. How many times its original value will the bond be worth, after 15 years?

23. Find the x-value of the minimum of the function $f(x) = 4e^{-x} + x$.