Math 125 Problem Bank | **Group** ________ | **Name** ______________________
Lessons 1-19 | **Section** ________ | **NetID** ______________________

This document contains an archive of practice problems I created for use in the University of Tennessee-Knoxville Spring 2020's iteration of MATH 125 basic calculus. They are listed in the same order as the lesson plan for the course.

(1) Evaluate the limit $\lim_{x\to 16} \sqrt[4]{x}$. If the limit does not exist, write DNE.

(2) The function $g(x) = \frac{x^2+6x+8}{x+2}$ has a removable discontinuity at $x = -2$. What value should we redefine $g(-2)$ to be if we want g to be continuous?

(3) Evaluate the limit $\lim_{x\to 27} \sqrt[3]{x}$. If the limit does not exist, write DNE.

(4) The function $g(x) = \frac{x^2-6x-16}{x-8}$ has a removable discontinuity at $x = 8$. What value should we redefine $g(8)$ to be if we want g to be continuous?

(5) Evaluate the limit $\lim_{x\to 64} \sqrt[4]{x}$. If the limit does not exist, write DNE.

(6) The function $g(x) = \frac{x^2+5x+6}{x+3}$ has a removable discontinuity at $x = -3$. What value should we redefine $g(-3)$ to be if we want g to be continuous?

(7) Evaluate the limit $\lim_{x\to 36} \sqrt{x}$. If the limit does not exist, write DNE.

(8) The function $g(x) = \frac{x^2+3x-10}{x-2}$ has a removable discontinuity at $x = 2$. What value should we redefine $g(2)$ to be if we want g to be continuous?

(9) Consider the function $f(x) = 2x^2 - 2$. Find the value of $\lim_{h\to 0} \frac{f(x+h)-f(x)}{h}$.

(10) Given your answer to Problem 1, identify all point(s) (the **ordered pair(s)**) where the tangent line to the graph of $f(x)$ is horizontal. If there are no such points, write "None."

(11) Consider the function $f(x) = 2x^2 - 2$. Find the value of $\lim_{h\to 0} \frac{f(x+h)-f(x)}{h}$.

(12) Given your answer to Problem 1, identify all point(s) (the **ordered pair(s)**) where the tangent line to the graph of $f(x)$ is horizontal. If there are no such points, write "None."

(13) Consider the function $f(x) = 2x^2 + 1$. Find the value of $\lim_{h\to 0} \frac{f(x+h)-f(x)}{h}$.

(14) Given your answer to Problem 1, identify all point(s) (the **ordered pair(s)**) where the tangent line to the graph of $f(x)$ is horizontal. If there are no such points, write "None."

(15) Consider the function $f(x) = 5x^2 + 4$. Find the value of $\lim_{h\to 0} \frac{f(x+h)-f(x)}{h}$.

(16) Given your answer to Problem 1, identify all point(s) (the **ordered pair(s)**) where the tangent line to the graph of $f(x)$ is horizontal. If there are no such points, write "None."

Using the definition of the derivative, find $f'(x)$ when $f(x) = x + 5$.

(17) Find the derivative of the function $f(x) = 5x^2 + \frac{2}{3}x^{-3}$. Use correct notation.

(18) Find the derivative of the function $g(x) = (3x)^{-2}$. Use correct notation. For this problem consider using algebra rules to rewrite the function first.

(19) Find the derivative of the function $f(x) = 7x^2 + \frac{1}{3}x^{-3}$. Use correct notation.

(20) Find the derivative of the function $g(x) = (4x)^{-3}$. Use correct notation. For this problem consider using algebra rules to rewrite the function first.

(21) Find the derivative of the function $f(x) = -2x^2 - \frac{1}{3}x^{-3}$. Use correct notation.

(22) Find the derivative of the function $g(x) = (3x)^{-3}$. Use correct notation. For this problem consider using algebra rules to rewrite the function first.

(23) Find the derivative of the function $f(x) = -4x^2 + \frac{7}{3}x^{-3}$. Use correct notation.

(24) Find the derivative of the function $g(x) = (2x)^{-4}$. Use correct notation. For this problem consider using algebra rules to rewrite the function first.

(25) Find the average rate of change (AROC) of the function $f(x) = 2x^3 - 5$ on the interval $[1, 3]$.

(26) Find the instantaneous rate of change of the function $f(x) = 2x^3 - 5$ at the point $x = 2$.

(27) Using complete sentence(s), explain the difference between average rate of change and instantaneous rate of change.

(28) Find the average rate of change (AROC) of the function $f(x) = 4x^3 - 3$ on the interval $[1, 3]$.

(29) Find the instantaneous rate of change of the function $f(x) = 4x^3 - 3$ at the point $x = 2$.

(30) Find the average rate of change (AROC) of the function $f(x) = 2x^3 + 1$ on the interval $[2, 4]$.

(31) Find the instantaneous rate of change of the function $f(x) = 2x^3 + 1$ at the point $x = 3$.

(32) Find the average rate of change (AROC) of the function $f(x) = 5x^3 - 6$ on the interval $[1, 3]$.

(33) Find the instantaneous rate of change of the function $f(x) = 5x^3 - 6$ at the point $x = 2$.

(34) Find the derivative of the function $f(x) = \frac{2x}{(x+3)^2}$ using the Quotient Rule and Chain Rule. Use correct notation.

(35) Find the derivative of the function $f(x) = 2x(x+3)^{-2}$ using the Product Rule and Chain Rule. Use correct notation.

(36) Find the derivative of the function $f(x) = \frac{4x}{(x+2)^3}$ using the Quotient Rule and Chain Rule. Use correct notation.

(37) Find the derivative of the function $f(x) = 4x(x+2)^{-3}$ using the Product Rule and Chain Rule. Use correct notation.

(38) Find the derivative of the function $f(x) = \frac{2x}{(x-1)^3}$ using the Quotient Rule and Chain Rule. Use correct notation.

(39) Find the derivative of the function $f(x) = 2x(x-1)^{-3}$ using the Product Rule and Chain Rule. Use correct notation.

(40) Find the derivative of the function $f(x) = \frac{-2x}{(x+1)^3}$ using the Quotient Rule and Chain Rule. Use correct notation.

(41) Find the derivative of the function $f(x) = -2x(x+1)^{-3}$ using the Product Rule and Chain Rule. Use correct notation.

(42) If $f(x) = \frac{3x}{(x^2+5x+1)^2}$, find $f'(x)$.

(43) Let $f(x) = x^4 + 2x^2 - 1$. Find $f''(x)$.

(44) Suppose $f^{(5)}(x) = 3x^2 + 1$. Find $f^{(7)}(x)$.

(45) Let $f(x) = x^3 - 5x^2 - 1$. Find $f''(x)$.

(46) Suppose $f^{(4)}(x) = 5x^2 + 22$. Find $f^{(6)}(x)$.

(47) Let $f(x) = 2x^2e^x$. Find $f'(x)$.

(48) Suppose $g(x) = \ln(x^5)$. Find the slope of the tangent line of g when $x = 2$.

(49) Let $f(x) = 3x^3e^x$. Find $f'(x)$.

(50) Suppose $g(x) = \ln(x^4)$. Find the slope of the tangent line of g when $x = -3$.

(51) If $S(t) = \frac{2t}{e^t+1}$ represents the position of a particle, find the velocity and acceleration functions. I suggest rewriting the function using algebra first.

(52) If $S(t) = \frac{2e^{2t}}{t}$ represents the position of a particle, find the velocity and acceleration functions. I suggest rewriting the function using algebra first.

(53) If $S(t) = (t^2 + 2t + 1)^{-1}$ represents the position of a particle, find the velocity and acceleration functions. I suggest rewriting the function using algebra first. Try to factor the polynomial!

(54) If $f(x) = \frac{x^3}{x^3+1} - 12x^2$, find $f'(x)$.

(55) If $f(x) = \frac{x^3}{x^2+1} - 6x^2$, find $f'(x)$.

(56) Let $g(x) = \frac{2x^4+x^3}{x^2+2}$. Find values of x for which the tangent line of g is horizontal.

(57) Find the critical number(s) of $f(x) = \frac{x^2+5x}{x-2}$. If there are none, say "None."

(58) Find all relative extrema of $f(x) = \frac{4}{3}x^3 - 4x^2$. For this problem I expect to see you draw a table like the ones on page 64 of your Note-Taking Guide.

(59) Find the critical number(s) of $f(x) = \frac{x^2+2x}{x-3}$. If there are none, say "None."

(60) Find all relative extrema of $f(x) = x^3 - \frac{9}{2}x^2$. For this problem I expect to see you draw a table like the ones on page 64 of your Note-Taking Guide.

(61) Find the critical number(s) of $f(x) = \frac{x^2-x}{x+3}$. If there are none, say "None."

(62) Find all relative extrema of $f(x) = \frac{1}{3}x^3 - 3x^2$. For this problem I expect to see you draw a table like the ones on page 64 of your Note-Taking Guide.

(63) Find the critical number(s) of $f(x) = \frac{x^2+x}{x-5}$. If there are none, say "None."

(64) Find all relative extrema of $f(x) = \frac{4}{3}x^3 + 4x^2$. For this problem I expect to see you draw a table like the ones on page 64 of your Note-Taking Guide.

(65) Draw a continuous function that has no relative maximum and no relative minimum.

(66) Draw a continuous function with no absolute maximum and two relative minima.

(67) Draw a function on the closed interval $[0, 1]$ with the absolute maximum at an endpoint and the absolute minimum at a critical number.

(68) The demand function for tickets for a flight from Knoxville to Miami is $p(x) = 3600 - 12x$. Find the price that will maximize revenue.

(69) Upon retirement you decide to move to a rural area with lots of open land to plant trees and vegetables. You want to enclose an area of $12,100$ square feet with a fence that costs \$15 per foot to build. What is the smallest amount of fencing [perimeter] you need to accomplish this goal, and how much does it cost?

(70) The demand function for tickets for a flight from Knoxville to Denver is $p(x) = 6000 - 6x$. Find the price that will maximize revenue.

(71) Upon retirement you decide to move to a rural area with lots of open land to plant trees and vegetables. You want to enclose an area of $14,400$ square feet with a fence that costs \$7 per foot to build. What is the smallest amount of fencing [perimeter] you need to accomplish this goal, and how much does it cost?

(72) The demand function for tickets for a flight from Knoxville to Austin is $p(x) = 4500 - 9x$. Find the price that will maximize revenue.

(73) Upon retirement you decide to move to a rural area with lots of open land to plant trees and vegetables. You want to enclose an area of $10,000$ square feet with a fence that costs \$12 per foot to build. What is the smallest amount of fencing [perimeter] you need to accomplish this goal, and how much does it cost?

(74) The demand function for tickets for a flight from Knoxville to Charlotte is $p(x) = 5600 - 8x$. Find the price that will maximize revenue.

(75) Upon retirement you decide to move to a rural area with lots of open land to plant trees and vegetables. You want to enclose an area of $10,000$ square feet with a fence that costs \$11 per foot to build. What is the smallest amount of fencing [perimeter] you need to accomplish this goal, and how much does it cost?

(76) Find this indefinite integral: $\int 12x^5 + 8x^{\frac{1}{2}}\,dx$. Don't forget to include a $+C$.

(77) Circle all indefinite integrals below that require u-substitution. You don't have to actually perform the u-substitutions.

$$\int -x^5 \left(-\frac{1}{6}x^6 + 7\right)^{12} dx$$

$$\int (3x^4 + 9)^7 x^3 dx$$

$$\int 3x^4 + 9dx$$

$$\int (3x^4 + 9)^7 dx$$

(78) Find this indefinite integral: $\int 18x^5 + 11x^{\frac{1}{2}}\,dx$. Don't forget to include a $+C$.

(79) Circle all indefinite integrals below that require u-substitution. You don't have to actually perform the u-substitutions.

$$\int 3x^4 + 9dx$$
$$\int -x^5\left(-\frac{1}{6}x^6 + 7\right)^{12} dx$$
$$\int (3x^4 + 9)^7 dx$$
$$\int (3x^4 + 9)^7 x^3 dx$$

(80) Find this indefinite integral: $\int 8x^3 + 4x^{\frac{1}{2}}\,dx$. Don't forget to include a $+C$.

(81) Circle all indefinite integrals below that require u-substitution. You don't have to actually perform the u-substitutions.

$$\int (3x^4 + 9)^7 x^3 dx$$
$$\int (3x^4 + 9)^7 dx$$
$$\int 3x^4 + 9dx$$
$$\int -x^5\left(-\frac{1}{6}x^6 + 7\right)^{12} dx$$

(82) Find this indefinite integral: $\int 4x^3 + 7x^{\frac{1}{2}}\,dx$. Don't forget to include a $+C$.

(83) Circle all indefinite integrals below that require u-substitution. You don't have to actually perform the u-substitutions.

$$\int (3x^4 + 9)^7 x^3 dx$$

$$\int 3x^4 + 9dx$$

$$\int (3x^4 + 9)^7 dx$$

$$\int -x^5 \left(-\frac{1}{6}x^6 + 7\right)^{12} dx$$

(84) Find the antiderivative $\int \frac{1}{5}(x^4 + 2x^2)(4x^3 + 4x)dx$. Try to do this two ways: by expanding and using the power rule, AND by using u-substitution.

(85) Refer to the "Summary of Integration Rules" table we filled out together in class. When do you use the formulas with x in them (the left column), and when do you use the formulas with u in them (the right column)?

(86) Find the two points of intersection ("little a and little b") for the functions $f(x) = x^2 - x$ and $g(x) = 9x - 16$. Describe, *using complete sentences*, why we need to find the values of a and b to find the area between the curves f and g (you don't actually have to find the area).

(87) Describe, *using complete sentences*, the difference between consumer surplus and producer surplus.

(88) Find the two points of intersection ("little a and little b") for the functions $f(x) = x^2 + 5x$ and $g(x) = 14x + 22$. Describe, *using complete sentences*, why we need to find the values of a and b to find the area between the curves f and g (you don't actually have to find the area).