

UNIT 4 GUIDE

Note: Video titles are clickable links.

Readings Day 19

(1) Read in OpenStax: Section 3.8

(a) Problem-Solving Strategy: Implicit Differentiation

Videos Day 19

(1) [Introduction to Implicit Differentiation](#)

(2) [Implicit Differentiation Examples](#)

Pre-Class Quiz 19

(1) Why might we need to use implicit differentiation?

- ☐ (a) The relationship between the variables is only implied; we don't know very much about it.
- ☐ (b) The equation giving the relationship between the variable is NOT solved for the dependent variable.
- ☐ (c) The equation giving the relationship between the variable IS solved for the dependent variable.
- ☐ (d) The relationship between the variable cannot be expressed using mathematical symbols.

(2) Choose all that apply. Let $y = f(x)$. Then $\frac{d}{dx}(y^2) = \frac{d}{dx}(f(x)^2)$ equals...

- ☐ (a) $2y$
- ☐ (b) $2y \cdot (dy/dx)$
- ☐ (c) $2f(x)$
- ☐ (d) $2f(x)f'(x)$

Readings Day 20

- (1) Friday will be a continuation of Wednesday's material, so there is no pre-class reading for Friday.

Videos Day 20

nothing

Pre-Class Quiz 20

- (1) We've learned that $\frac{d}{dx}(\sin x) = \cos x$ but $\frac{d}{dx}(\sin y) = \cos y \left(\frac{dy}{dx}\right)$. A group of students were discussing why this is the case. Which students are on the right track? **Select all that apply.**
- ☐ (a) y is a function of x and we have to use the chain rule
 - ☐ (b) The derivative of sine is cosine and the derivative of y is dy/dx , so using the chain rule, the derivative of $\sin y = \cos y(dy/dx)$
 - ☐ (c) We could do both of these problems the same way and use the chain rule on $d/dx(\sin x)$ to get that $d/dx(\sin x) = \cos x(dx/dx)$, but $dx/dx = 1$. So, these really aren't that different.
 - ☐ (d) Because this is \sin times y , so we take the derivative of \sin and then multiply it by the derivative of y .
- (2) What is the derivative of $f(x) = e^y$?
- (3) Which of the following topics do you still have questions about in regards to the chain rule? **Choose ALL that apply.**
- ☐ (a) How to use the chain rule with implicit differentiation
 - ☐ (b) When to use implicit differentiation
 - ☐ (c) The process of doing implicit differentiation

Readings Day 21

- (1) Monday will be review of Unit 3, so there is no pre-class reading Monday.

Videos Day 21

nothing

Pre-Class Quiz 21

- (1) How has the time length allowed for the quizzes been for you so far?
- ☐ (a) 2 hours has been plenty of time.

- ☐ (b) 2 hours has been just enough time.
 - ☐ (c) A few more minutes would be great.
 - ☐ (d) More than 2 hours, 30 minutes would be great.
- (2) What concepts do you have the most questions on in unit 3? **Select all that apply.**
- ☐ (a) Product and quotient rules
 - ☐ (b) Trig and exponential derivatives
 - ☐ (c) The chain rule
 - ☐ (d) Using multiple rules at once

Readings Day 22

- (1) Read in OpenStax: Section 3.7
- (a) **Note:** We won't specifically use Theorem 3.11, but you may see it referenced in Knewton Alta
 - (b) Theorem 3.12 - Extending the Power Rule to Rational Exponents. This is proving this rule for rational exponents
 - (c) Theorem 3.13 - Derivatives of Inverse Trig Functions
- (2) Read in OpenStax: The subsection of Section 3.9 titled "Derivative of the Logarithmic Function" through Checkpoint 3.53
- (a) Theorem 3.15 - The Derivative of the Natural Logarithmic Function

Videos Day 22

- (1) [Inverse of Cosine](#)

Pre-Class Quiz 22

- (1) Determine $\frac{dy}{dx}$ for the following curves: $e^y = x$, $\sin(y) = x$, $\cos(y) = x$.
- (2) A boat sails directly toward a 150-meter tall skyscraper that stands on the edge of a harbor. Let x be the horizontal distance between the base

of the building and the boat. The angle θ , measured in degrees, is the angle of elevation from the boat to the top of the building.

- (a) Sketch picture of this situation
- (b) If the angle of elevation is 45° , how far from the building is the boat?

Readings Day 23

- (1) Read in OpenStax: Section 4.1

(a) Problem Solving Strategy: Solving a Related-Rates Problem

Videos Day 23

- (1) [Related Rates](#)

Pre-Class Quiz 23

- (1) A spherical balloon is being inflated at a constant rate. The volume of a sphere is given by $V = \frac{4}{3}\pi r^3$. As air goes into the balloon, what quantities are changing over time? **Select all that apply.**
 - ☐ (a) The volume of the balloon, V , is changing.
 - ☐ (b) The radius of the balloon, r , is changing.
 - ☐ (c) The pi of the balloon, π , is changing.
 - ☐ (d) The exponent of the radius is changing.
- (2) Two airplanes are flying in the air at the same height. Airplane A is flying east at 250 mph and airplane B is flying north at 200 mph. They are both heading toward the same airport. What quantities are changing over time? **Select all that apply.**
 - ☐ (a) The distance airplane A has traveled.
 - ☐ (b) The distance airplane B has traveled.
 - ☐ (c) The distance between the two airplanes.
 - ☐ (d) The location of the airport.

(3) What questions do you currently have about related rates?

- ☐ (a) What equations should be used for a particular context.
- ☐ (b) How to take the derivative of the equation being used.
- ☐ (c) How to solve for a particular rate.
- ☐ (d) Knowing when to plug numbers in.
- ☐ (e) I have no questions at this time

Readings Day 24

- (1) Wednesday will be a continuation of Monday's material, so there is no new reading for Wednesday.

Videos Day 24

nothing

Pre-Class Quiz 24

- (1) Suppose that the length, l , width, w , and area, $A = lw$, of a rectangle are differentiable functions of t . (Meaning that all three quantities change as time changes.) Write an equation that related $\frac{dA}{dt}$ to $\frac{dl}{dt}$ to $\frac{dw}{dt}$ when $l = 5$ and $w = 3$.

$$\frac{dA}{dt} = [\text{answer1}] \frac{dl}{dt} + [\text{answer2}] \frac{dw}{dt}$$

- (2) In the following equation, both x and y change with time, t . If $y = 5x^2 - 14$ and $\frac{dx}{dt} = 4$, find $\frac{dy}{dt}$ when $x = -6$.

(3) What questions do you currently have about related rates?

- ☐ (a) What equations should be used for a particular context.
- ☐ (b) How to take the derivative of the equation being used.
- ☐ (c) How to solve for a particular rate.
- ☐ (d) Knowing when to plug numbers in.
- ☐ (e) I don't have any questions right now