Slope Failure and Calculus

Content Area(s)/Course/Grade: AP Calculus	Unit: Techniques of Integration
Lesson Topic: Antiderivative	Length of Lesson: 1 Days
Materials for Students: Calculator and writing utensil	Materials for Teacher: guided worksheet/notes/presentation

Standard(s) Addressed:
Finding Antiderivatives and Indefinite Integrals: Basic Rules and Notation

Student Outcome(s):
I can find the antiderivative of basic functions (all polynomial, some rational, some trigonometric)

Context for Learning

This lesson is vital to the unit as it is the main method of finding integral. This will help develop into the first fundamental theorem of calculus. This lesson will not have any ties to Slope Failure and Rain Fall focus.

Instructional Delivery

Lesson notes: Guided notes will cover the idea of thinking backwards from a derivative. Applying the idea of an inverse function we can show how to get the antiderivative. The notes will show the antiderivative for select trigonometric functions and create the power rule for antiderivatives. (notes will be attached)

Activity: None

Assessment/Evaluation (Formative/Summative)

There will be an informal formative assessment in the form of their worksheet. Gather how they are doing by walking around to each student and observing them work. There will be a formal formative assessment the day after this lesson in the form of a mini quiz that will be one power rule and one will be a trigonometric question. (worksheet and mini quiz will be attached with this lesson plan)

Accommodation: Make sure everyone has a calculator for this worksheet. Reduce the amount of question for those who need it. Walk around and help those students that need more help. Extra time for students that need it on the mini quiz.

Slope Failures and Calculus
Lesson 2 Anti-Derivative

Objectives: To be able to find the original function given a derivative. Given integral be able to find anti-derivatives for simple cases.

If we know the derivative of a function is 5? List 3 possibilities for what the original function could be.

Find the original function for:

$f'(x) = x^2$

$f'(x) = \cos x$

The integral symbol, $\int$, tells you to take the anti-derivative and “dx” denotes that you are looking at the derivative of x.

$\int 3x dx$

$\int \sqrt{x} dx$

$\int \frac{1}{x^3} dx$

$\int \sqrt[4]{x} dx$

$\int 2sinx\, dx$

$\int dx$

$\int \frac{x+1}{\sqrt{x}}\, dx$

$\int \frac{\sin x}{\cos^2 x}\, dx$

Sometimes we are given extra information about the function so we are able to find out what “c” is. Example find f(x) if f’(x)=$2x^2$ and f(3)=4

The relationship we have studied with position, velocity, and acceleration will continue to be used.

As a log falls in a waterfall, its velocity is $v(t)=-32t-18$ in feet per second. The position of the log at time $t=0$ was at the top of the waterfall, 500 feet above sea level.

a. Where is the log after 2 seconds?

b. Where is the log after t seconds? What is another name for this function?

Differential Equations: Equations that are derivatives.

To solve differential equations, take the anti-derivative.

Solve the differential equation: $f'(x) = 4x \; and \; f(0) = 6$

Again: $f'(x) = 6x^2 \; and \; f(0) = -1$

A ball is thrown upward with an initial velocity of 64 feet per second from an initial height of 80 feet.

A.) Find the position function giving the height as a function of time.

B.) When does the ball hit the ground?

Find $f(x)$ given $f''(x)=2$ and $f'(1)=5$ and $f(2)=10$.

Slope Failure and Calculus Lesson 2 Name:____________________________

1. Verify the statement by showing that the antiderivative of the right side equals the integrand of the left side.

a. $\int (-\frac{9}{x^4})dx = \frac{3}{x^3} + C$

b. $\int \frac{x^2-1}{x^{3/2}}dx = \frac{2(x^2+3)}{3\sqrt{x}} + C$

2. Find the general solution of the differential equation and check the result by differentiation.

a. $dy / dt = 3t^2$

b. $dr / d\theta = \pi$

3.

Original Integral	Rewrite	Integrate	Simplify
$\int \frac{1}{x^2}dx$			
$\int x(x^2+3)dx$			
$\int \frac{1}{(3x)^2}dx$			

Find the indefinite integral and do a mental check of your result by differentiation.

4. $\int (2x - 3x^2) dx$

5. $\int (x^3 - 4x + 2) dx$

6. $\int (\sqrt{x} + \frac{1}{2\sqrt{x}}) dx$

7. $\int (\sqrt[4]{x^3} + 1) dx$

8. $\int \frac{1}{x^3} dx$

9. $\int \frac{x^2 + x + 1}{\sqrt{x}} dx$

10. $\int \frac{x^3 + 2x - 3}{x^4} dx$

11. $\int (x + 1)(3x - 2) dx$

12. $\int (2t^2 - 1)^2 dt$

14. $\int y^2 \sqrt{y} dy$

15. $\int 3 dt$

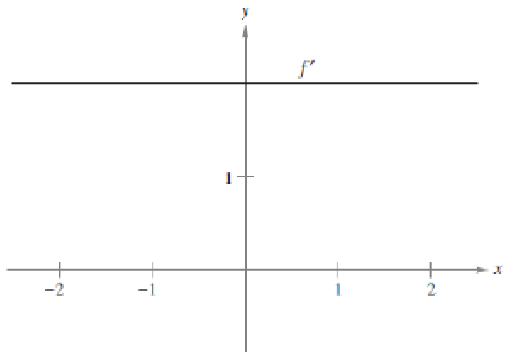
16. $\int (2\sin x + 3\cos x) dx$

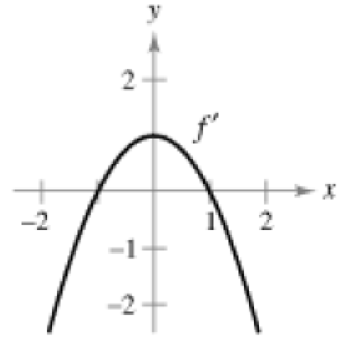
17. $\int (1 - \csc t \cot t) dt$

18. $\int (\theta^2 + \sec^2 \theta) d\theta$

20. $\int \sec y (\tan y - \sec y) dy$

21. The graph of the derivative of a function is given. Sketch the graph of TWO functions that have the given derivative. There are many correct answers.

a. 

b. 

24. Solve the differential equation:

a. $f'(x) = 6x^2, f(0) = -1$

b. $f''(x) = x^2, f'(0) = 6, f(0) = 3$

25. A ball is thrown vertically upward from a height of 6 feet with an initial velocity of 60 feet per second. How high will the ball go?

28. A balloon, rising vertically with a velocity of 16 feet per second, releases a sandbag at the instant it is 64 feet per second above the ground.

a. How many seconds after its release will the bag strike the ground?

b. With what velocity will it hit the ground?

29. Determine whether the statement is true or false. If it is false, explain why or give a counterexample.

a. Each antiderivative of an nth-degree polynomial function is an (n+1)th-degree polynomial function.

b. If $p(x)$ is a polynomial function, then p has exactly one antiderivative whose graph contains the origin.

c. If $F(x)$ and $G(x)$ are antiderivatives of $f(x)$, then $F(x) = G(x)+c$.

d. The antiderivative of $f(x)$ is unique.

SF and Calc Lesson 2 Mini Quiz Name: ________________

Find the antiderivative or indefinite integral of the following two functions.

$\int 5\sin(x)\,dx$ $\int 13x^5 dx$

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