## 4.8

Wednesday, November 4, 2020

12:36 PM



Math 1300: Calculus I

Fall 2020

Lecture: Section 4.8: Antiderivatives

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Today's Goal: Learn about antiderivatives!

Logistics: We will start and finish this section on Wednesday. Don't forget Check-In 14 on Friday! Review sections 4.6 and 4.8 (this section!).

Warm-Up 1.1 Find two positive numbers whose sum is 300 and whose product is a maximum.

- (A) 150, 150
- (B) 100, 200
- (C) 50, 250
- (D) 300, 300
- (E) None of the above

p'(x) = 300 - 2x = 0 2x = 300 x = 150 $p''(x) = -2 \rightarrow p is co$ 

Antiderivatives 1.1

1.1.1 Terminology

Find the derivative of  $f(x) = x^3 - 2x + 1$ :

$$f'(x) = 3x^2 - 2$$

Let's just name this new function g(x):

$$g(x) = 3x^2 - 2$$

Since the derivative of f(x) is equal to g(x), we say that f(x) is an **antiderivative** of g(x).

**Question:** Are there other anti-derivatives of g(x)?

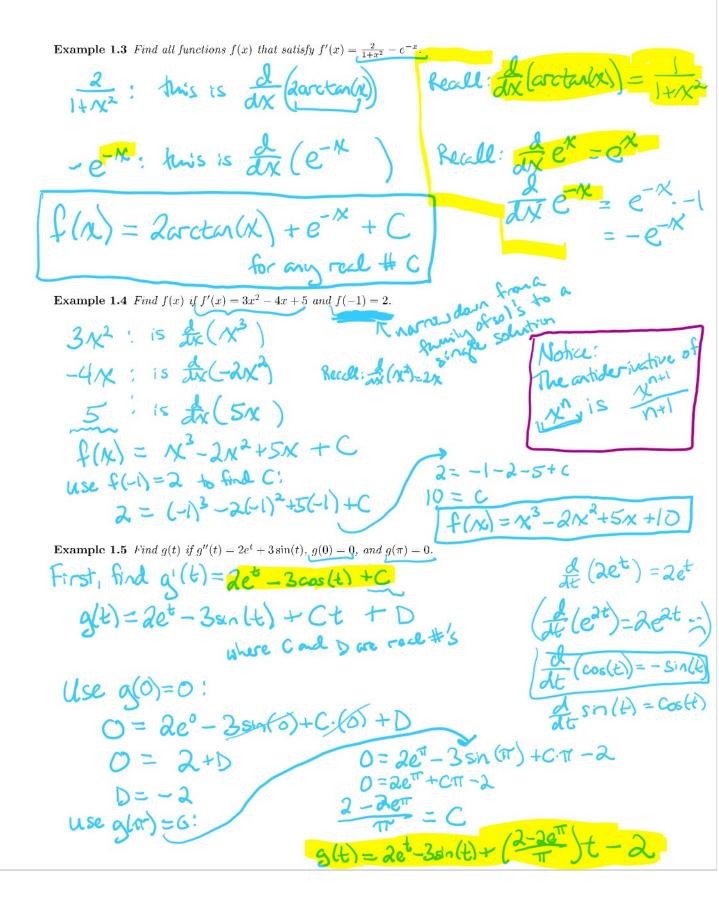
Here other anti-derivatives of g(x)?

Yes,  $\chi^3 - 2\chi + C$ , for any real # C

A few examples:  $f(\chi) = \chi^3 - 2\chi + 4$ 

**Theorem 1.2** If F(x) is an antiderivative of f(x), then so is F(x) + C, for any real number C.

 $\ell(x) = 3x^2 - \lambda$   $x^3 - 2x + C$ 



Recall now and always that the acceleration due to gravity is  $-9.8m/s^2$ , or equivalently  $-32ft/s^2$ .

**Example 1.6** A ball is thrown upward with a speed of 48 ft/s from the edge of a cliff 432 ft above the ground. Find its height above the ground t seconds later. When does it reach its maximum height? When does it hit the ground?

the ground? 
$$a(t) = -32$$
,  $c^{\text{relf}}$   $v(t)$  is an antiderivative of alt)  $v(t) = -32t + C$  Find  $c$  in singly  $v(0) = 48$   $v(0) = 48 = C$   $v(t) = -32t + 48$   $v(t)$  is an antideriv of  $v(t)$   $v(t) = -32t + 48$   $v(t)$  is an antideriv of  $v(t)$   $v(t) = -16t^2 + 48t + C$  (rew result  $c$ )  $v(t) = -16t^2 + 48t + C$  (rew result  $c$ )  $v(t) = -16t^2 + 48t + C$   $v(t) = -16t^2 + 48t + 432$   $v(t) = -16t^2 + 48t + 432$ 

**Example 1.7** A stone was dropped off a cliff and hit the ground with a speed of 120 ft/s. What is the height of the cliff?