



S6.1 – Analyzing Antiderivatives Algebraically

Assaf Bar-Natan

“ Now the teacher would say to learn your algebra
But I'd bring home C's and D's
How could I make an A when there's a swingin' maid
On the left and on the right and in the back and the front of me? ”

–“ Straight A's in Love ”, Johnny Cash

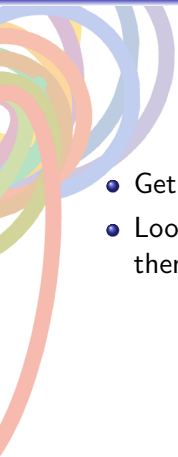
Jan. 17, 2020

WeBWork Reflection



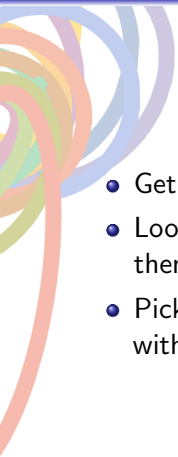
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WeBWork Reflection



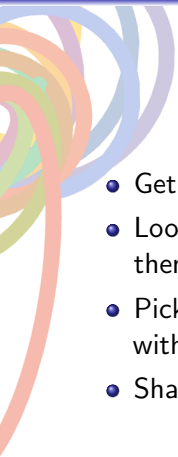
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- Get into groups of two or three.
- Look around you for someone who is not in a group, and invite them to your group.
- Pick a WeBWork question from this section that you struggled with.
- Share with your group your progress or how you solved it.

Takeaway



MAT136 tip: WeBWork questions are hard! Help each other!



Submissions Closed

What type of object is each of the following 'integrals'?

Premise

1 $\int_t^3 f(x) dx$

→ A function of t

2 $\int_{\pi}^{100} g(t) dt$

→ B infinite family of functions

3 $\int 2 dx$

→ C function of x

4 $\int_1^x h(t) dt$

→ D number

202/202 answered

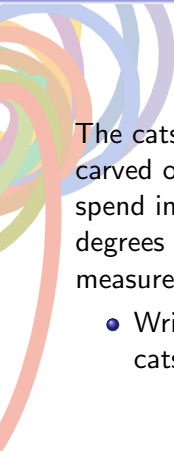
[Ask Again](#)



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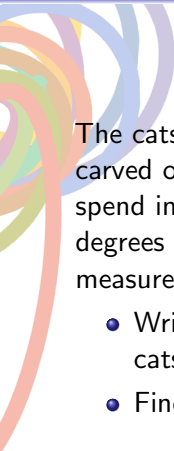
Cats and Hay-Bales



The cats (Marzipan, Obie, Blackie, and Roy) are cuddling up in a carved out hay bale. Let t be the time, in minutes, that the cats spend in the cavity. They heat up the cavity at a rate of $3e^{-0.2t}$ degrees Celsius per minute. After six minutes, the temperature was measured to be 13°C .

- Write an expression for the temperature two minutes after the cats jumped into the cavity.

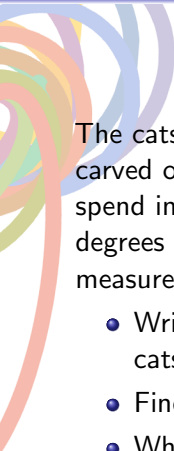
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- Write an expression for the temperature two minutes after the cats jumped into the cavity.
- Find the antiderivative of $3e^{-0.2t}$.

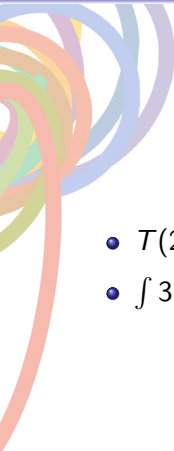
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- Write an expression for the temperature two minutes after the cats jumped into the cavity.
- Find the antiderivative of $3e^{-0.2t}$.
- What was the temperature when $t = 2$?

Solution

- 
- $T(2) = 13 - \int_2^6 3e^{-0.2t} dt$
 - $\int 3e^{-0.2t} dt = 3 \int e^{-0.2t} dt = \frac{3e^{-0.2t}}{-0.2}$

Takeaway



For any function, f , and a co-ordinate (x, y) , there is a single antiderivative F , for which $F(x) = y$.



Submissions Closed

If F and G are antiderivatives of f , then $F - G$ is an antiderivative of

A f

B $2f$

C Any constant

D 0

208/209 answered

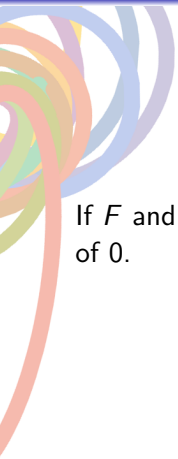
[Ask Again](#)



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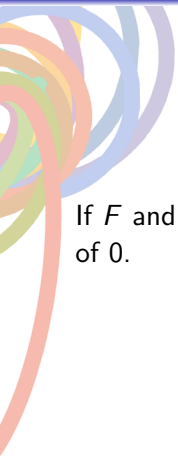


Punctuated Lecture – Finding All Antiderivatives



If F and G are antiderivatives of f , then $F - G$ is an antiderivative of 0.

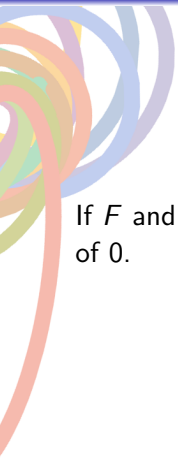
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This means that $F - G$ is constant.

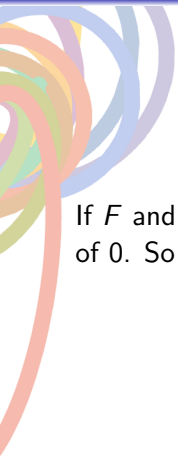
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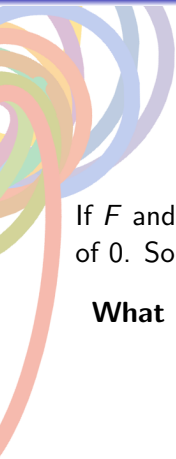
This means that $F - G$ is constant. **Why?**

Punctuated Lecture – Finding All Antiderivatives



If F and G are antiderivatives of f , then $F - G$ is an antiderivative of 0. So $F - G$ is constant.

Punctuated Lecture – Finding All Antiderivatives



If F and G are antiderivatives of f , then $F - G$ is an antiderivative of 0. So $F - G$ is constant.

What does this tell us about any other antiderivative of f ?

Cats and Logs

Mia and Obie are having a fight. Both want to compute $\int \frac{1}{5x}$.

Mia says:

"I can pull out $\frac{1}{5}$, and use

$$\frac{d}{dx} \log(|x|) = \frac{1}{x}$$

to get that every antiderivative of $\frac{1}{5x}$ is of the form $\frac{1}{5} \log(|x|) + C$."

Obie says:

"When I compute the derivative of $\frac{1}{5} \log(\pi|x|)$, I get $\frac{1}{5x}$, so

$$\frac{1}{5} \log(\pi|x|)$$

is an antiderivative of $\frac{1}{5x}$ that doesn't fit your pattern."

Who is right?

Solution

Both are right, because if we apply logarithm rules, we get:

$$\frac{1}{5} \log(\pi|x|) = \frac{1}{5} \log(|x|) + \frac{1}{5} \log(\pi)$$

which is of the form that Mia wanted.

Plans for the Future



For next time:

WeBWork 6.3 and read section 6.3