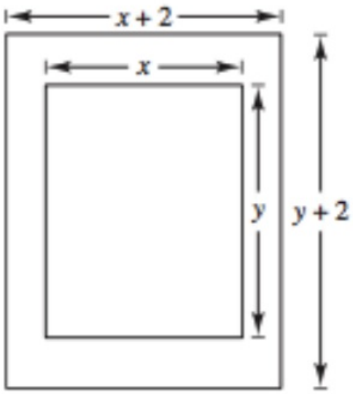
Good afternoon class: Mr Mohyuddin is (sadly) out at a math meeting but Ms Bryan is here to sub today :)

You will be receiving practice assessments for related rates shortly
Solutions are posted at mcalc.weebly.com but give them an honest attempt first!

reminders:
- tutoring is still available today after school
- no open lunch tomorrow thanks

Optimization hw p 220

17. x=sqrt(30), plug back in to find y, y=sqrt(30). dimensions are 2+sqrt(30)



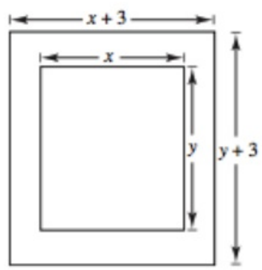
18. $xy = 36 \Rightarrow y = \frac{36}{x}$

$$A = (x+3)(y+3) = (x+3)\left(\frac{36}{x}+3\right)$$

$$= 36 + \frac{108}{x} + 3x + 9$$

$$\frac{dA}{dx} = \frac{-108}{x^2} + 3 = 0 \Rightarrow 3x^2 = 108 \Rightarrow x = 6, y = 6$$

Dimensions: 9×9



19. 700 by 350

20.

$$S = 2x^2 + 4xy = 337.5$$

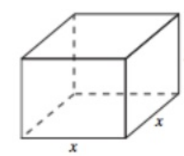
$$y = \frac{337.5 - 2x^2}{4x}$$

$$V = x^2y = x^2\left[\frac{337.5 - 2x^2}{4x}\right] = 84.375x - \frac{1}{2}x^3$$

$$\frac{dV}{dx} = 84.375 - \frac{3}{2}x^2 = 0 \Rightarrow x^2 = 56.25 \Rightarrow x = 7.5 \text{ and } y = 7.5.$$

$$\frac{d^2V}{dx^2} = -3x < 0 \text{ for } x = 7.5.$$

The maximum value occurs when $x = y = 7.5$ cm.



Please work on the practice assessment for the remainder of class
If finished checking solutions online, finish up the optimization/rates hw if needed

Good afternoon: no warm up, will take notes when bell rings

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Indefinite Integration aka Antidifferentiation

a quick example to dissect:

$$\int x^2 \, dx = \frac{1}{3} x^3 + C$$

variable of integration (must match variable of integrand)
(usually dx, just like with derivatives)

$$\int x^2 \, dx = \frac{1}{3} x^3 + C$$

answer

<u>integral sign</u>
(says, "here's a derivative... what was the original function??")

<u>integrand</u>
thing we are finding the antiderivative of

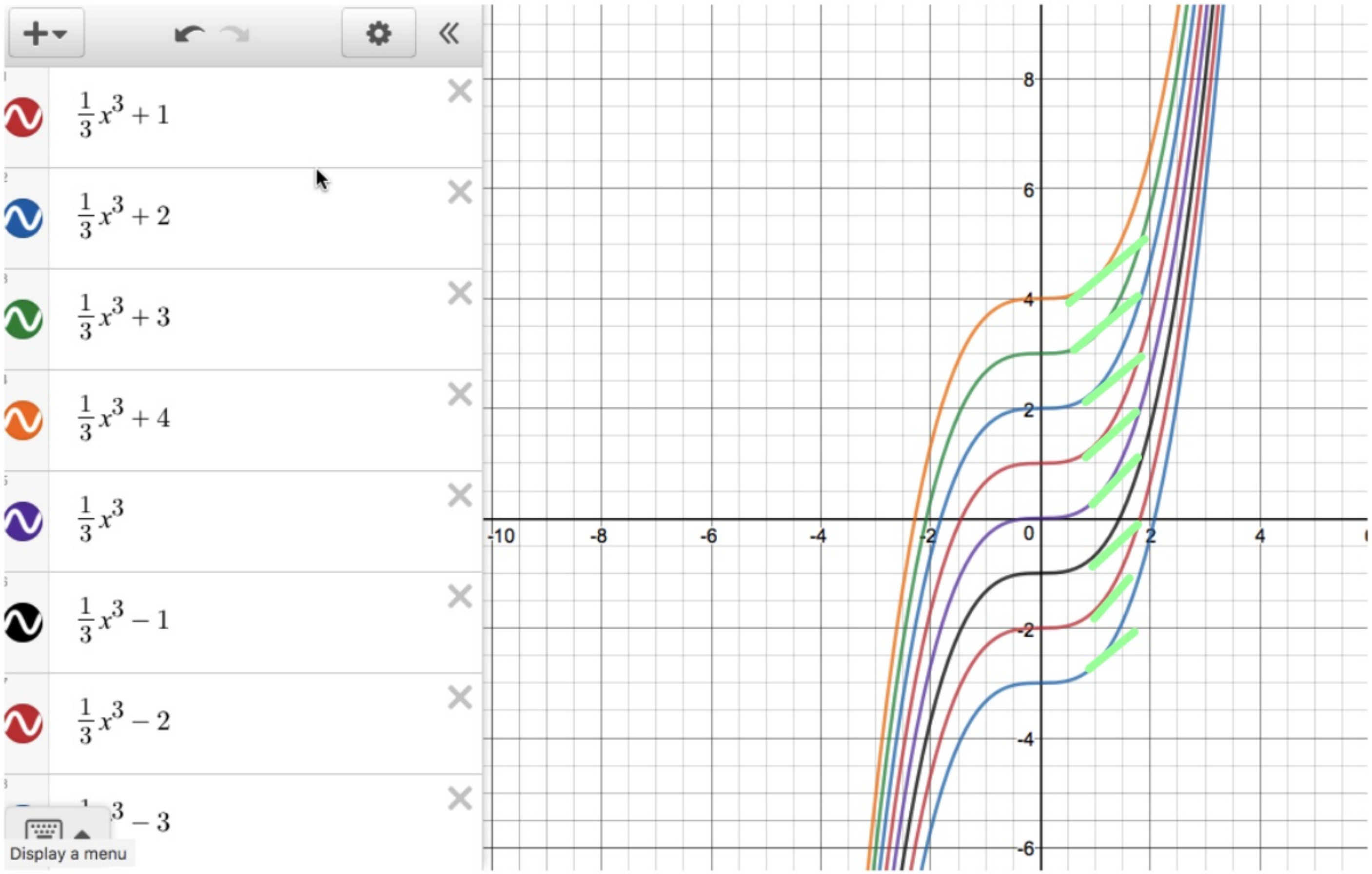
<u>Constant of integration</u>
(more on this in a moment)

$$\int x^2 \, dx = \frac{1}{3} x^3 + C$$

The solution to an indefinite integral is a family of functions

x^2 is the derivative of $1/3\ x^3$, but also $1/3\ x^3 + 1$, $1/3x^3 + 4$, $1/3x^3$ -22.1....etc

Because they all have the same slopes!! adding C is just a vertical translation



Notice that all of these have the same slopes at any given x-value

Algebraically:

when you take the derivative of a constant, it goes away! so any constant could be in the original problem but disappears when given the integrand

$$\int 2x \; dx = x^2 + c$$

derivative of x^2+53 (for example) is 2x

derivative of $x^2 - 12$ is also 2x

hence, the + C

How to check if you're right??

Just take the derivative of your answer and see if you get the integrand!!

integration

$$\int \cos(x) \; dx = \sin(x) + C$$

differentiation

The Reverse Power Rule

remember this? the power rule:

$x^n \rightarrow nx^{n-1}$

1. multiply by exponent
2. decrement exp by 1

So in the opposite direction....

divide

1. ~~multiply~~ by exponent
2. ~~decrement~~ exp by 1

increment

So in the opposite direction....

divide
1. ~~multiply~~ by exponent
2. ~~decrement~~ exp by 1
increment

example:

$$\int 3x^5\,dx$$

(ignore the 3, treat it as a coefficient as with derivs.)

$$\frac{3x^6}{6} + C$$

$$\frac{1}{2}x^6 + C$$

check to see if it's right!!

Reverse Power Rule (Add to booklets...first ever integration formula :)

$$\int x^n \, dx = \frac{x^{n+1}}{n+1} + C$$

example in notes:

$$\int 4x^2 - 6x^4 \quad dx$$

(recall that derivative of sum or difference is just sum/diff of the derivatives....same holds true in reverse!!)

$$\int 4x^2 - 6x^4 \quad dx$$

$$4\frac{x^3}{3} - 6\frac{x^5}{5} + C$$

$$\frac{4}{3}x^3 - \frac{6}{5}x^5 + C$$

Always check to make sure it's right if ever unsure!

Lots to put into your booklets: p. 246 right column

Differentiation Formula	Integration Formula
$\frac{d}{dx}[C] = 0$	$\int 0\,dx = C$
$\frac{d}{dx}[kx] = k$	$\int k\,dx = kx + C$
$\frac{d}{dx}[kf(x)] = kf'(x)$	$\int kf(x)\,dx = k\int f(x)\,dx$
$\frac{d}{dx}[f(x) \pm g(x)] = f'(x) \pm g'(x)$	$\int [f(x) \pm g(x)]\,dx = \int f(x)\,dx \pm \int g(x)\,dx$
$\frac{d}{dx}[x^n] = nx^{n-1}$	$\int x^n\,dx = \frac{x^{n+1}}{n+1} + C, \quad n \neq -1$ Power Rule
$\frac{d}{dx}[\sin x] = \cos x$	$\int \cos x\,dx = \sin x + C$
$\frac{d}{dx}[\cos x] = -\sin x$	$\int \sin x\,dx = -\cos x + C$
$\frac{d}{dx}[\tan x] = \sec^2 x$	$\int \sec^2 x\,dx = \tan x + C$
$\frac{d}{dx}[\sec x] = \sec x \tan x$	$\int \sec x \tan x\,dx = \sec x + C$
$\frac{d}{dx}[\cot x] = -\csc^2 x$	$\int \csc^2 x\,dx = -\cot x + C$
$\frac{d}{dx}[\csc x] = -\csc x \cot x$	$\int \csc x \cot x\,dx = -\csc x + C$

ADD THESE

example:

$$\int \frac{2}{\sqrt[3]{x}} \; dx$$

$$\int \frac{2}{\sqrt[3]{x}}\ dx$$

rrrrrrreeemix

$$\int \frac{2}{x^{1/3}}\ dx$$

$$\int 2x^{-\frac{1}{3}}\ dx$$

$$2\frac{x^{\frac{2}{3}}}{\frac{2}{3}} + C$$

$$\frac{2}{1} \cdot \frac{3}{2}\ x^{2/3} + C \rightarrow 3x^{2/3} + C$$

Dividing fractions:

$$\frac{a}{\frac{b}{c}} \rightarrow \frac{a}{1} \cdot \frac{c}{b} \rightarrow \frac{ac}{b}$$

"keep it, flip it, change it"

see p248 for more examples

classwork/homework

- p 251: #7-26, 5(
- practice assessment on related rates