

Agenda

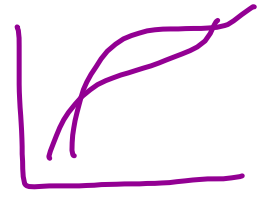
Project Information

Lecture Fundamental Theorem of Calculus

Project for Fundamental Theorem

Project

Project Rubric



(Poster)

Data	Graph	Limits	Deriv	Integral	Shaded Pie	ARC	Conclusions
4-Meaning	4-all	4-all	4-all	4-all	4-all	4-given/sh	4-many
3-No units	3-no data/	3-missing r	3-missing n	3-missing n	3-no data/	3-given	3-error
2-No source	2-One Graph	2-not inter	2-not relev	2-no ave w	2-unclear	2-shown	2-derivative/int
1-Neither	1-no units	1-neither	1-neither	1-neither	1-wrong ar	1-wrong	1-limit

(Worksheet)

1-data/regressions	2-ARC	3- Limits/Ends	4-Poly 'y'	5-Transcendental 'y, y''	6-MVT /Newtons	7-error	8-Geography	9- Area / Ave	10-FTC and Sumseq	Pictures
										4-exact
										3-missing u
										2-regressio
										1-wrong

(Presentation)

1. Were you reviewed? Who reviewed you? 4=TWO 2=ONE	2. Were you prepared with your worksheet, calculator, and poster? 4=ALL 3=MISSING 1 2=MISSING 1=PRESENT ED ON TIME	3. Did you introduce self, describe data, and express why you are interested? 4=ALL 3=NO 2=NO 1=PRESENT DATA 1=NO ENERGY	4. Did you present a good graph with two or more regressions and the data? 4= NICE GRAPH 3=NO LABELS 2=NOT TWO 1=WRONG	5. Did you make a statement/prediction using limits? Something next or ending? 4=Both limits 3= missing limit 2=Not said 1=nonsense	6. Did you make a statement/prediction using both rates of changes? 4= Both rates said 3=both w/mistake 2=One rate said 1=one with mistake	7. Did you make a statement/prediction using integrations/sumations? 4= said and done 3=a mistake 2=Missing 1=wrong	8. Did you discuss the geography of relevant regression(s) including Max/Mins, Ends, Increasing/Decreasing, Concavity, and especially the Inflection Points? 4=all 2=missing	9. Did you discuss the Error and Field Questions? Why that regression? Why that prediction? 4= error well said 3=missing something 2=not right 1= no questions	10. Is your presentation Interesting, Relevant, and Informative and under 5 minutes long? 4= all 3=too long 2=not relevant 1=not interesting
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① Worksheet.

② Poster (best parts
of worksheet)

③ Presentation (like
poster)

Poster

Cross Movie Poster
X

Movie Trailer

Tell everything?

Review.

Interesting ✓

Relevant ✓

Informative ✓

F.T.C.

Antiderivative \rightarrow

indefinite integral

$$f(n) \rightarrow F(n)$$

$$4 \rightarrow 4n^0 \leftarrow \int 4 \, dn$$

$$n \rightarrow \frac{n^2}{2} \leftarrow \int n \, dn$$

$$n^2 \rightarrow \frac{n^3}{3} \leftarrow \int n^2 \, dn$$

$$\int_a^b f(x) dx$$

definite integral
Area Under Curve
f(x) between a and b

Fundamental Theorem of Calculus

$$\int_a^b f(x) dx = F(b) - F(a)$$

area = antiderivative

Notation

$$\int_a^b f(x) = F(b) - F(a)$$

= $F(b) - F(a)$ written

$$F(x) \Big|_a^b$$



$$F(b) - F(a)$$

$$F(x) \Big|_{x=a}^b$$

Ex

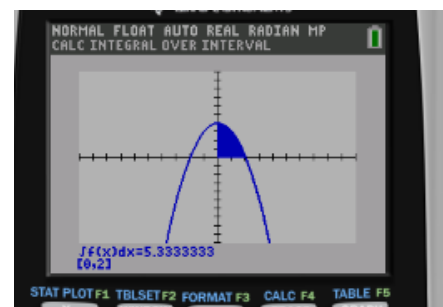
$$\int_0^2 (4 - x^2) dx = \left[4x - \frac{x^3}{3} \right]_0^2 = 5\frac{1}{3}$$

$(8 - \frac{8}{3}) - (0 - 0) = 5\frac{1}{3}$

$$F(x) = \int (4 - x^2) dx = 4x - \frac{x^3}{3}$$

$$F(2) = 4(2) - \frac{2^3}{3} = 5\frac{1}{3}$$

$$F(0) = 4(0) - \frac{0^3}{3} = 0$$



STAT PLOT F1 TBLSET F2 FORMAT F3 CALC F4 TABLE F5

fnInt(4-X^2,X,0,2)
5.333333333

Plot1 Plot2 Plot3
Y1=4X-X^3/3
Y1(2)-Y1(0)
5.333333333

Written also

$$\int_{x=0}^2 4-x^2 \cdot dx = 4x - \frac{x^3}{3} + C \Big|_{x=0}^2$$

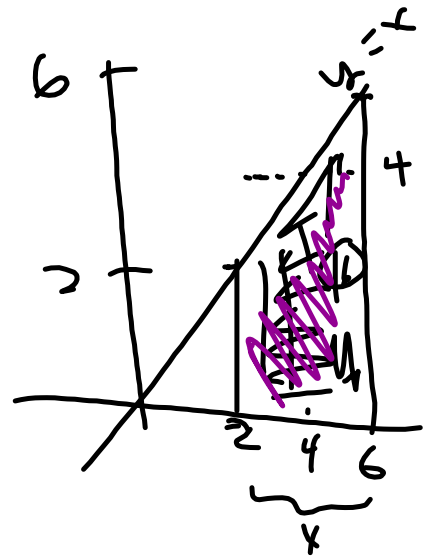
That means

$$\left(4(2) - \frac{2^3}{3} + C \right) = \left(4(0) - \frac{0^3}{3} + C \right)$$

ex.

FTC

$$\int_2^6 x \, dx = 16$$



$$= \frac{6^2}{2} - \frac{2^2}{2} = 18 - 2 = 16$$

Group work

$Y_1 = \text{regression}$

$Y_2 = \text{Anti-derivative}$

summary (———)

$$Y_2(b) - Y_2(a)$$



approx

exact

your regression:

1: find area from a to b

$$Y_1 = Ax^4 + Bx^3 + Cx^2 + Dx + E$$

zoom 9

ANTI DERIV

calc7 a to b

$$Y_2 = Ax^5/5 + Bx^4/4 + Cx^3/3 + Dx^2/2 + Ex$$

Area between a & b

$$Y_2(b) - Y_2(a) =$$
$$= \text{Area}$$

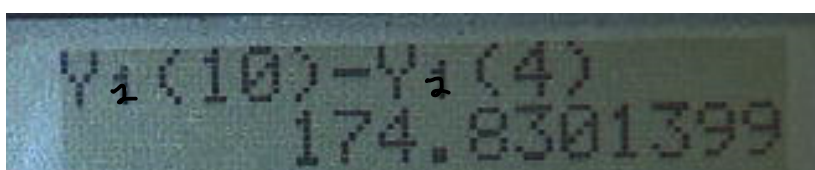
area under
quartic
regression

between 1 and
10

edit in calculator



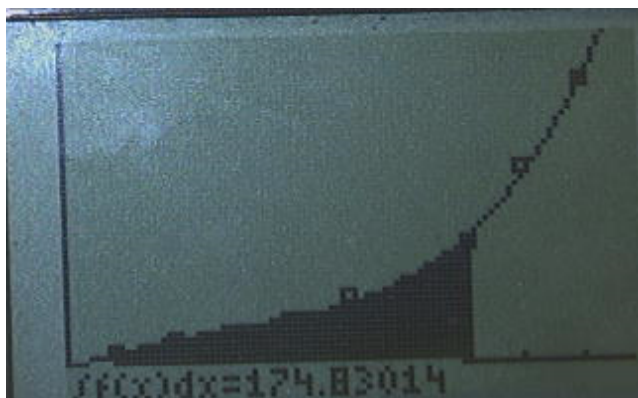
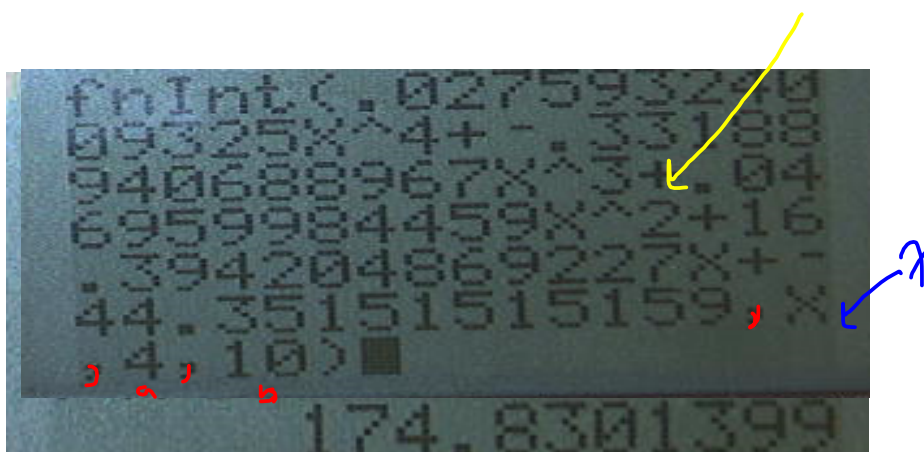
exit and evaluate

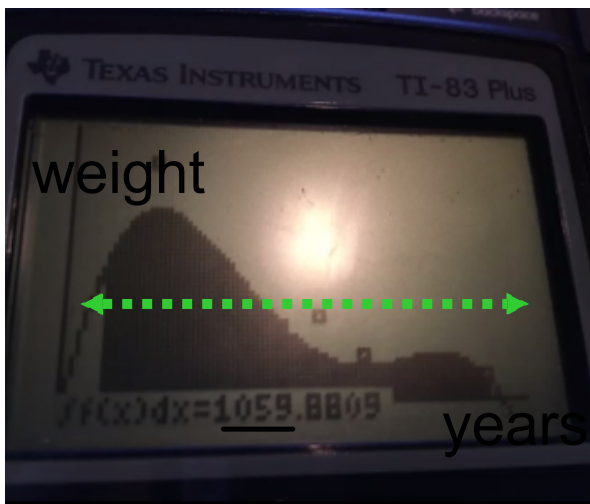


area under quartic regression between 4 and 10 - you use your own points

another method Math:7 fnint

vars 5 >> 1





$$Y_2(107) - Y_2(98) = 1059.881$$

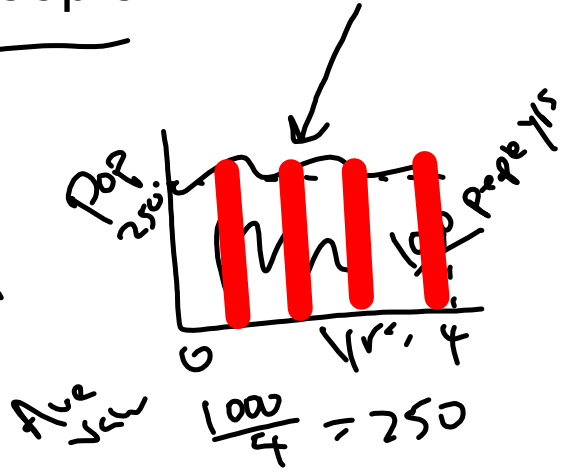
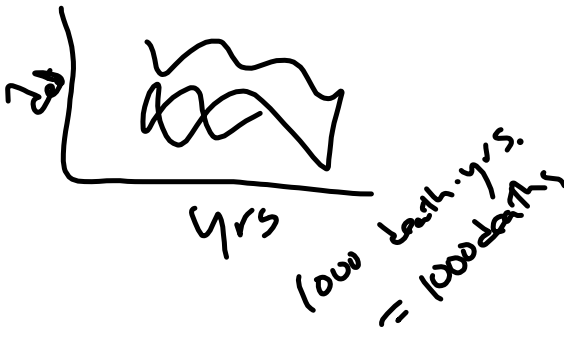
1059 year*lbs

but if $b-a=9$

$1059/9=117.67$ lbs

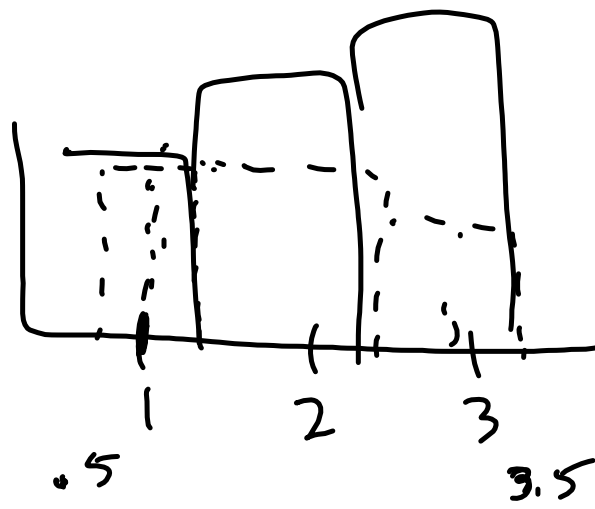
Average value of weight between the years 1998 and 2007, according to the quartic regression, is 118 lbs

Deaths versus living people

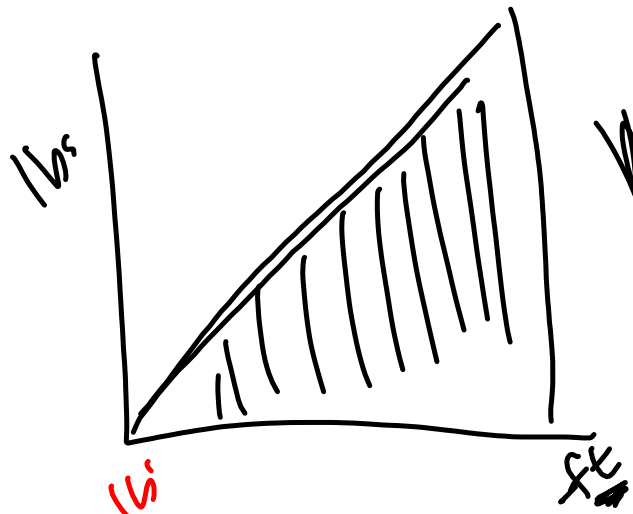


3 years.

\int_0^3 \int_1^4 $\int_{.5}^{2.5}$

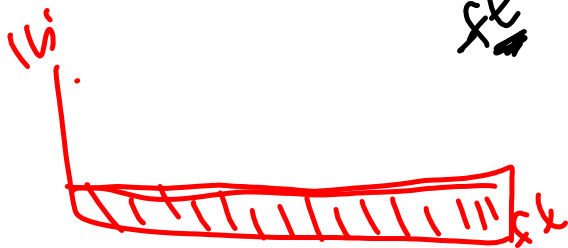


$0-3$ $.8-3.5$ $1-4$

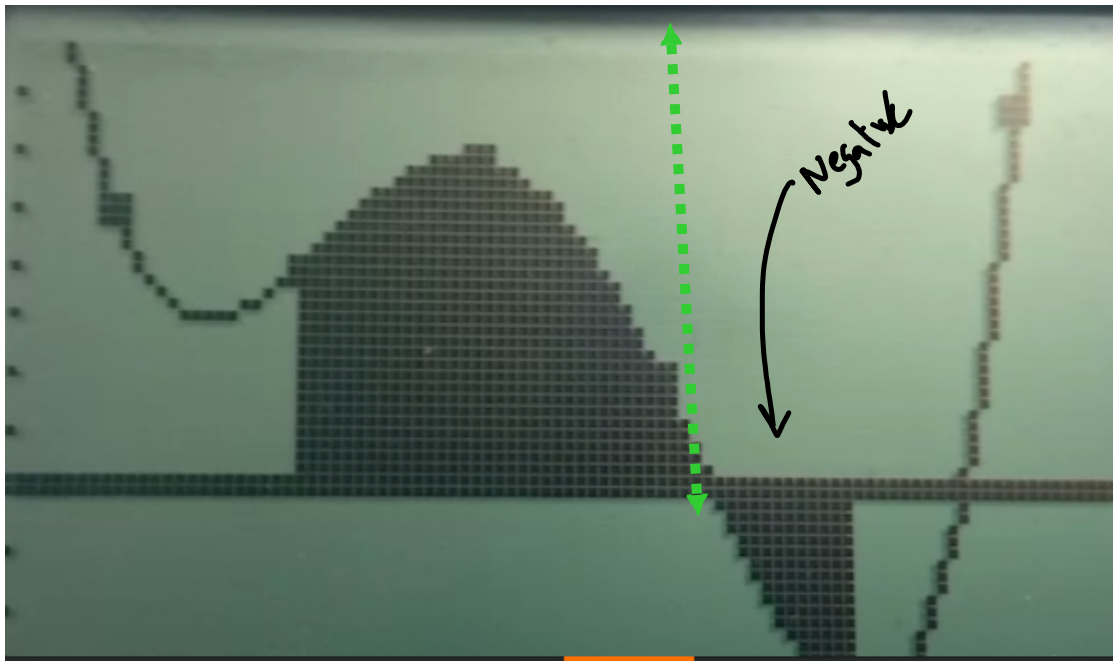


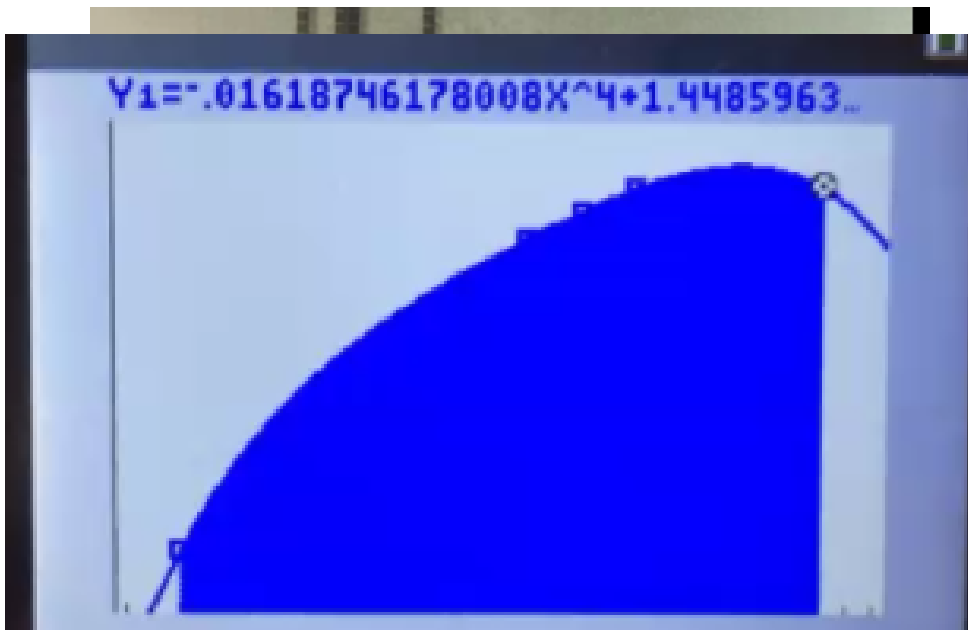
$$W = F \cdot d$$

↓ ↓
lbs ft



$Y_2(600) - Y_2(300)$
864.7499994





$\int(x)dx = 115349.3$

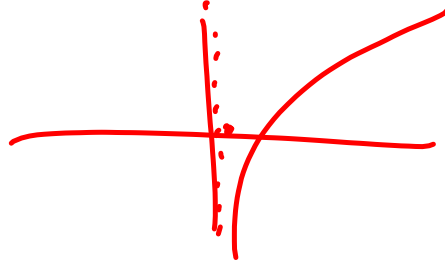
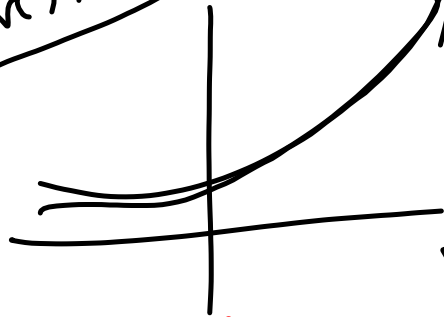
NORMAL FLOAT AUTO REAL RADIANS MP
 $Y_2(34) - Y_2(10)$
 115349.3032

According to the antiderivative of the quartic regression, the area between the years 1990 and 2014 is 115,349. morbid obesity.

$115349/24 = 4806$ cases of MO years

Project.
All regressions

Lin
 Q in
 Loh
 Qut
 Ex
 Ln
 Sin

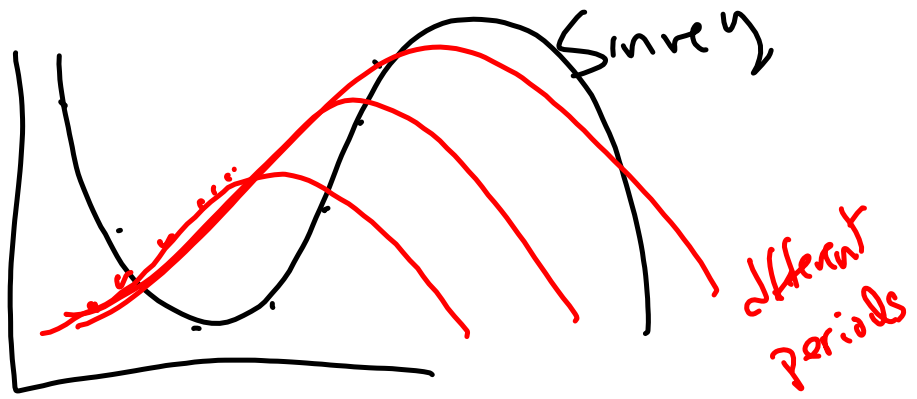


No
 Neg or 0.01
 y-value

No
 Neg or 0.01
 x-value

X	Y
0.5	0.8
6.6	7.0
6.5	7.1

X	Y
0.0	
-1	
-5	





$$F(b) \Rightarrow F(2021) = \$$$

Solve for b .

Preview of Rest of class

Chain Rule: $\frac{d}{dx} f(g(x)) = f'(g(x))g'(x)$
UNDO IT with substitution.

$$\int f'(g(x)) \cdot g'(x) dx = \int f'(u) du$$

Inside
Function $u = g(x)$
 $u' = g'(x) dx$

$$\begin{aligned} & F(u) + C \\ & \cancel{F} (g(x)) + C \end{aligned}$$

$$\int \sin(x^2) \cdot 2x dx$$

$$u = x^2$$

$$du = 2x dx$$

replace "u"

$$\begin{aligned} \int \sin(u) du \\ = -\cos(u) + C \\ = -\cos(x^2) + C \end{aligned}$$

Ex

$$\int e^{x^2} \cdot 2x dx = \int e^u du$$

$$u = x^2$$
$$du = 2x dx$$

$$\square \Rightarrow e^u + C$$
$$\square \Rightarrow e^{x^2} + C$$

$$\int \frac{\sin x}{\cos x} dx = \int -\frac{du}{u}$$

$$= -\int \frac{1}{u} du$$

$$= -\ln |u| + C$$

$$= -\ln |\cos x| + C$$

$$= \ln |\sec x| + C$$

$$\int \tan x dx = \ln |\sec x| + C$$

$u = \cos x$
 $du = -\sin x dx$
 $-du = \sin x dx$
 $\Rightarrow \int \tan x dx$

$$F(x) = \int x \cos x^2 \cdot 2x = \int \cos u \frac{du}{2}$$

$$u = x^2$$

$$du = 2x dx$$

$$\frac{du}{2} = x dx$$

$$= \frac{1}{2} \int \cos u du$$

$$= \frac{1}{2} \sin u + C$$

$$= \boxed{\frac{1}{2} \sin(x^2) + C}$$

$$\int_{x=0}^x \cos(x^2) dx$$

$$u = x^2$$

$$\frac{du}{2} = x dx$$

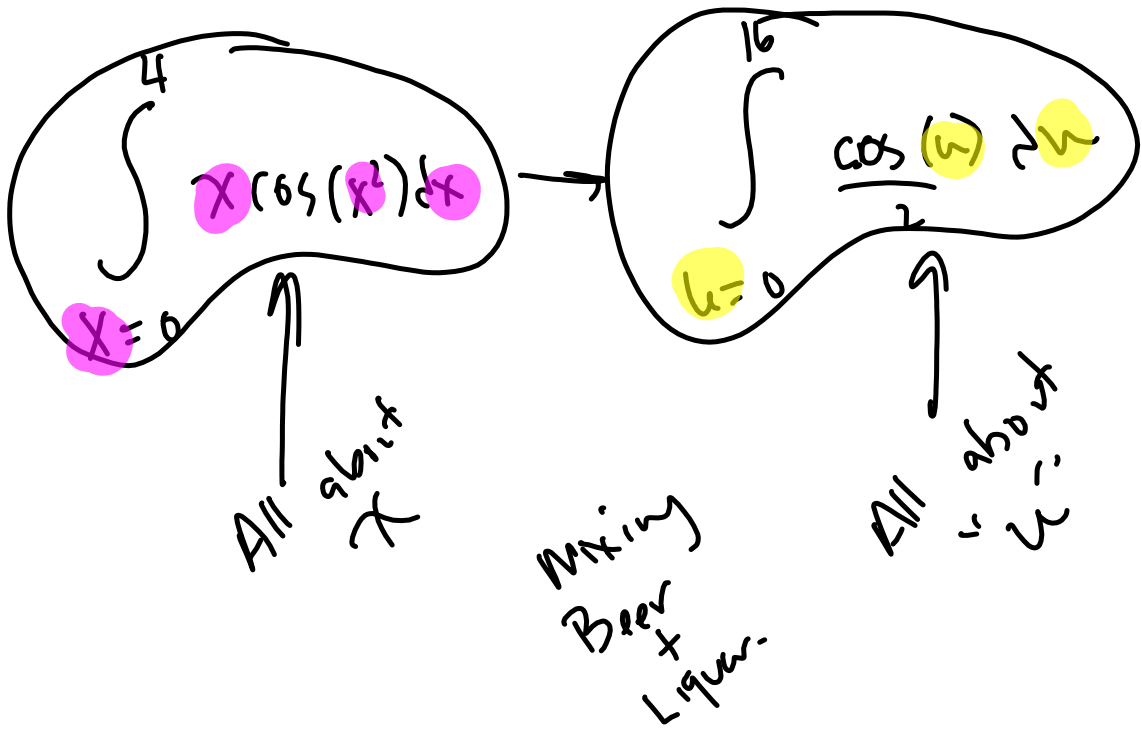
$$\int \cos(u) \frac{du}{2}$$

$$= \frac{1}{2} \int \cos(u) du$$

$$= \frac{1}{2} \sin(u) \Big|_0^{16}$$

$$= \frac{1}{2} \sin(16) - \frac{1}{2} \sin(0)$$

$$= \frac{1}{2} \sin(16)$$



later...

$$\begin{aligned} & \int_0^4 x \cos(x^2) dx = \int_0^{\frac{\pi}{2}} \cos u \frac{du}{2} \\ & \frac{1}{2} \left[\sin u \right]_0^{\frac{\pi}{2}} = \frac{1}{2} (\sin \frac{\pi}{2} - \sin 0) = \frac{1}{2} (1 - 0) = \frac{1}{2} \end{aligned}$$

Handwritten notes: $x = 0 \rightarrow u = 0$, $x = 4 \rightarrow u = \frac{\pi}{2}$, $\frac{du}{dx} = 2x \Rightarrow \frac{du}{2} = x dx$

```
NORMAL FLOAT AUTO a+bi RADIAN CL
fnInt(Xcos(X^2),X,0,4)
.....-.1439516583
sin(16)
.....-.2879033167
Ans/2
.....-.1439516583
```

Definite Integrals

Ex

$$\int_{x=1}^2 \sin x \cdot e^{\cos x} dx$$

$$u = \cos x$$

$$du = -\sin x dx$$

$$\int_{u=\cos(1)}^{\cos(2)} -e^u \cdot du$$

$$\stackrel{F.T.C.}{=} -e^u$$

$$\Big|_{\cos(1)}^{\cos(2)} = -e^{\cos(2)} + e^{\cos(1)}$$

$$\downarrow$$

$$\boxed{e^{\cos(1)} - e^{\cos(2)}}$$

Make the indicated substitution for an unspecified function $f(x)$.

$u = x^4$ for $\int_0^3 x^3 f(x^4) dx$

$\int_0^3 x^3 f(x^4) dx = \frac{1}{4} \int_0^3 f(u) du$

$\int_0^3 x^3 f(x^4) dx = \frac{1}{4} \int_0^{81} f(u) du$

$\int_0^3 x^3 f(x^4) dx = \frac{1}{4} \int_0^{81} f(u) du$

$x=3$
 $u = x^4$
 $u(3) = 3^4 = 81$

$u = x^4$
 $du = 4x^3 dx$

$\int x^3 f(x^4) dx$

$\frac{1}{4} \int f(u) du$

Make the indicated substitution for an unspecified function $f(x)$.

$$u = \sin x$$
$$du = \cos x dx$$

$u = \sin(x)$ for $\int_0^{\pi/2} 2 \cos(x) f(\sin(x)) dx$

~~$\int_0^{1/2} 2f(u) du$~~

$\int_0^1 2f(u) du$

~~$\int_0^1 f(u) du$~~

~~$\int_0^{1/2} f(u) du$~~

$x = \pi/2$
 $u = \sin x$
 $u = \sin \frac{\pi}{2}$
 $= 1$

$\int_0^1 2 f(u) du$

- Finish Quizzes / Homework
 - Practice test integral.
 - Test on Integrals
-

- Final

