Week 01: January 18th 2023	
WEEKUI: January 18, 2025	
Review	
Basic Properties of Derivatives	
Addition: $\frac{d}{dx} [f(x) + g(x)] = [f(x) + g(x)]' = f'(x) + g'(x)$	$\lambda = \frac{d}{dx} \int_{-\infty}^{\infty} \frac{dx}{dx} dx$
Subtraction: $\frac{d}{dx} \left[f(x) - g(x) \right] = \left[f(x) - g(x) \right]' = f'(x) - g(x)$	
Coefficient: $\frac{d}{dx} \left[c \cdot f(x) \right] = \left[c \cdot f(x) \right]' = c \cdot f'(x) = c \cdot \frac{d}{dx}$	
Product: dx [f(x)·g(x)] = [f(x)·g(x)] = f'(x)·g(x) + g'(x)	
Quotient: $\frac{d}{dx} \left[\frac{f(x)}{g(x)} \right] = \left[\frac{f(x)}{g(x)} \right]' = f'(x) \cdot g(x) - g'(x) \cdot f(x)$	$\frac{d}{dx} f(x) \cdot g(x) - \frac{d}{dx} g(x) \cdot f(x)$
(g(x)) ²	(g(x)) ²
Chain: $\frac{d}{dx} \left[f(g(x)) \right] = \left[f(g(x)) \right]' = f'(g(x)) \cdot g'(x) = \frac{d}{dx} f$	$(a(x)) \cdot \frac{d}{dx} a(x)$
Chair at England - Figure 9 and	gent ax gent
Common Derivatives	Basic Integrals
Constant: dx (K) = 0 K is a constant	Power: $\int x^n dx = \frac{1}{n+1} \cdot x^{n+1} + c$
Power: $\frac{d}{dx}(x^n) = n x^{n-1}$ n is a constant	Trig: $S \sin(x) dx = -\cos(x) + c$
Trig.: $\frac{d}{dx} (\sin(x)) = \cos(x)$	$S\cos(x) dx = \sin(x) + c$
$\frac{d}{dx}(\cos(x)) = -\sin(x)$	$\int \sec^2(x) dx = \tan(x) + c$
$\frac{a}{dx}(\tan(x)) = \sec^2(x)$	$\int \csc^2(x)dx = -\cot(x) + c$
$\frac{d}{dx}\left(\csc(x)\right) = -\csc(x)\cot(x)$	$\int_{C} csc(x) cot(x) dx = -csc(x) + c$
$\frac{dx}{dx}(sec(x)) = sec(x) tan(x)$	$\int \sec(x) \tan(x) dx = \sec(x) + c$
$\frac{d}{dx}\left(\cot(x)\right) = -\csc^{2}(x)$	
Derivative of Exponential & Logarithmic Functions	
20. 10.1110 of by portormal reagainting faile flore	+
Logarithmic Properties	Exponential Rules
Product: In(ab) = In(a)+In(b)	Product: $a^n \cdot a^m = a^{n+m}$
Quotient: $\ln(\frac{a}{b}) = \ln(a) - \ln(b)$	Guotient: $\frac{a^m}{a^n} = a^{n-m}$
Power: $\ln(a^n) = n \cdot \ln(a)$	Power: $a^n \cdot b^n = (ab)^n$
Log of 1: ln(1)=0	$\frac{a^n}{b^n} = \left(\frac{a}{b}\right)^n$
In of e: In(e)=1	
others: $ln(e^*) = x \cdot ln(e) = x$	
$e^{\ln(x)} = x$	
Derivatives	Anti-derivative
Exponential: dx (bx) = bx. In(b)	Exponential: 5 bx dx = In(b)·bx +c
$\frac{d}{dx}(e^x) = e^x \cdot \ln(e) = e^x$	$\int e^{x} dx = \frac{1}{\ln(e)} \cdot e^{x} + C = e^{x} + C$
Logarithmic: dx (logb(x))= xln(b)	Logarithmic: SxIn(b) dx = logb(x) +c
$\frac{dx}{dx}(\ln(x)) = \frac{1}{x \ln(e)} = \frac{1}{x}$	$S \neq dx = \ln(x) + C$

t vardicas				
Exercises				
1. Find the following derivatives	•	F(x)		
(a) $\frac{d}{dx}(x^3 + an(x))$		(b) dx (32x2-5x+3)		
f 3		gix		
$(x^3)' \cdot tan(x) + (tan(x))' \cdot x^3$ product	rule f'gtg'f	$(2x^2-5x+3)^{1/3}$		
	rule n x ⁿ⁻¹	$((2x^2-5x+3)^{1/3})^{1/3}$ • $(2x^2-5x)^{1/3}$	t3)' chain r	ule f'(g(x))·g'(x)
$3x^2 + an(x) + x^3 sec^2(x)$		$\frac{1}{3}(2x^2-5x+3^{-2/3}\cdot(4x-5)$		rule nxn-1
		4x-5 3 ³ (2x ¹ -5x+3 ¹	Power	1010
		3172-5115		
	1		11 1 /0 0	
2. Find the equation of the line	e tangent to the curve	2 XCOS(1724)=24-8 at	me point (0,2).
e 1. Cu + .1			<u> </u>	
Equation of the Tangent Line	**COS(H2Y) = 242-8		y-2= \$ cos(5) (
the derivative is the slope of	f'(x)·g(h(y)) + (g'(h(y))	·h'(y))·f(x)	y-2=8 cos(5))	
the tangent line	1 · cos(1+24) - sin(1+24)).24'. x = 444'	Y= 8 COS(5) X +	2
Point-slope linear form	cos(1+24) = 444' + 2x	sin(1+2y)·y1		
y-yo=m(x-xo)	cos(1+24) = 4' (44 + 2xsi	n(1+2y))		
	y'= Cos(1+24) 44+2xsin(1+24)			
Implicit Differentation				
take derivative of x terms normally	@ (0,2): \= \ \ \ = \ \ \ \ \ \ \ \ \ \ \ \ \ \	+z(2)))Sin (1+2(2))		
multiply by y when taking the	<u>cos(5)</u> = 8+0			
derivative of y with respect to x	= 8 cos(5)			
activative of a partition	8 43157			
3. Find a formula for the function the point (1,2).	n f(x) if its slope is	given by xsin(x²+1) an	d the graph of	f(x) passes through
the point (1,2).				
the point (1,2). ! We can not assume f(x) is linear	f(x)= Sxs	sin(x²+1) dx	U-Substitution	on
the point (1,2). ! We can not assume f(x) is linear so we use initial value rather than	f(x)= Sxs	in(x2+1) dx du = 2x dx	U-Substitution	on nd its derivative du
the point (1,2). ! We can not assume f(x) is linear so we use initial value rather than	$f(x) = \int_{0}^{\infty} x dx$ $u = x^{2} + 1$	in(x2+1) dx du = 2x dx \frac{1}{2} du = x dx	U-Substitution ·identify u and ·simply to re	on nd its derivative du ceive direct substitution
the point (1,2). ! We can not assume f(x) is linear so we use initial value rather than point-slope linear form!	$f(x) = \int x s$ $u = x^2 + 1$ $= \int sint$	in(x²+1) dx du = 2x dx \frac{1}{2} du = x dx u) \cdot \frac{1}{2} du	U-Substitution ·identify u and ·simply to re ·solve for new	on nd its derivative du ceive direct substitution s bounds by plugging in
the point (1,2). ! We can not assume f(x) is linear so we use initial value rather than point-slope linear form! Initial Value Problem	$f(x) = \int xs$ $u = x^{2} + 1$ $= \int sint $ $= \frac{1}{2} \int si$	in(x²+1) dx du= 2x dx \(\frac{1}{2} \) du= x dx u) \(\frac{1}{2} \) du in(u) du	U-Substitution ·identify u and ·simply to re ·solve for new	on nd its derivative du ceive direct substitution
the point (1,2). ! We can not assume f(x) is linear so we use initial value rather than point-slope linear form! Initial Value Problem f(x) = S f'(x) dx	$f(x) = \int xs$ $u = x^{2} + 1$ $= \int sint$ $= \frac{1}{2} \int si$ $= \frac{1}{2} \left(-c \right)$	in(x²+1) dx du = 2x dx \(\frac{1}{2} \) du = x dx u) \(\frac{1}{2} \) du in(u) du cos(u)) + C	U-Substitution ·identify u and ·simply to re ·solve for new	on nd its derivative du ceive direct substitution s bounds by plugging in
the point (1,2). ! We can not assume $f(x)$ is linear so we use initial value rather than point-slope linear form! Initial Value Problem $f(x) = \int f'(x) dx$ 'solve for c using	$f(x) = \int xs$ $u = x^{2} + 1$ $= \int sint$ $= \frac{1}{2} \int si$ $= \frac{1}{2} \left(-c \right)$	in(x²+1) dx du= 2x dx \(\frac{1}{2} \) du= x dx u) \(\frac{1}{2} \) du in(u) du	U-Substitution identify u and simply to restant to solve for new the original	on nd its derivative du ceive direct substitution s bounds by plugging in bounds into the u-equati
the point (1,2). ! We can not assume $f(x)$ is linear so we use initial value rather than point-slope linear form! Initial Value Problem $f(x) = \int f'(x) dx$	$f(x) = \int xs$ $u = x^{2} + 1$ $= \int sint$ $= \frac{1}{2} \int si$ $= \frac{1}{2} (-c)$ $= -\frac{1}{2} co$	in(x²+1) dx du = 2x dx \(\frac{1}{2} \) du = x dx u) \(\frac{1}{2} \) du in(u) du cos(u)) + C	U-Substitution identify u and simply to restant to solve for new the original	on nd its derivative du ceive direct substitution s bounds by plugging in
the point (1,2). ! We can not assume $f(x)$ is linear so we use initial value rather than point-slope linear form! Initial Value Problem $f(x) = \int f'(x) dx$ 'solve for c using	$f(x) = \int xs$ $u = x^{2} + 1$ $= \int sint$ $= \frac{1}{2} \int si$ $= \frac{1}{2} (-c)$ $= -\frac{1}{2} co$	$\sin(x^2+1) dx$ $du = 2x dx$ $\frac{1}{2} du = x dx$ $u) \cdot \frac{1}{2} du$ $\sin(u) du$ $\cos(u) + C$ $\sin(u) + C$	U-Substitution identify u and simply to restant to solve for new the original	on nd its derivative du ceive direct substitution s bounds by plugging in bounds into the u-equati
the point (1,2). ! We can not assume $f(x)$ is linear so we use initial value rather than point-slope linear form! Initial Value Problem $f(x) = \int f'(x) dx$ 'solve for c using	$f(x) = \int xs$ $u = x^{2} + 1$ $= \int sin l$ $= \frac{1}{2} \int si$ $= \frac{1}{2} \left(-c \right)$ $= -\frac{1}{2} co$ $= -\frac{1}{2} co$	$\sin(x^2+1) dx$ $du = 2x dx$ $\frac{1}{2} du = x dx$ $u) \cdot \frac{1}{2} du$ $\sin(u) du$ $\cos(u) + C$ $\sin(u) + C$	U-Substitution identify u and simply to restant to solve for new the original	on nd its derivative du ceive direct substitution s bounds by plugging in bounds into the u-equati
the point (1,2). ! We can not assume $f(x)$ is linear so we use initial value rather than point-slope linear form! Initial Value Problem $f(x) = \int f'(x) dx$ 'solve for c using	$f(x) = \int xs$ $u = x^{2} + 1$ $= \int sin l$ $= \frac{1}{2} \int si$ $= \frac{1}{2} \left(-c \right)$ $= -\frac{1}{2} co$ $= -\frac{1}{2} co$	$ \frac{\sin(x^2+1)}{\sin(x^2+1)} dx $ $ \frac{1}{2} du = x dx $ $ \frac{1}{2} du $ $ \frac{1}{2} du $ $ \frac{1}{2} du $ $ \frac{1}{2} du $ $ \frac{1}{2} cos(u) + c $ $ \frac{1}{2} cos(s) + c $	U-Substitution identify u and simply to restant to solve for new the original	on nd its derivative du ceive direct substitution s bounds by plugging in bounds into the u-equati
the point (1,2). ! We can not assume f(x) is linear so we use initial value rather than point - slope linear form! Initial Value Problem f(x) = S f'(x) dx 'solve for c using initial value	$f(x) = \int xs$ $u = x^{2} + 1$ $= \int sin l$ $= \frac{1}{2} \int si$ $= \frac{1}{2} (-c)$ $= -\frac{1}{2} co$ $= -\frac{1}{2} co$ $2 = f(1) = -\frac{1}{2} co$	$ \frac{\sin(x^2+1)}{\sin(x^2+1)} dx $ $ \frac{1}{2} du = x dx $ $ \frac{1}{2} du $ $ \frac{1}{2} du $ $ \frac{1}{2} du $ $ \frac{1}{2} du $ $ \frac{1}{2} cos(u) + c $ $ \frac{1}{2} cos(s) + c $	U-Substitution identify u and simply to restant to solve for new the original	on nd its derivative du ceive direct substitution s bounds by plugging in bounds into the u-equati
the point (1,2). ! We can not assume f(x) is linear so we use initial value rather than point - slope linear form! Initial Value Problem • f(x) = S f'(x) dx • solve for c using initial value	$f(x) = \int xs$ $u = x^{2} + 1$ $= \int sin l$ $= \frac{1}{2} \int si$ $= \frac{1}{2} \left(-c \right)$ $= -\frac{1}{2} co$ $= -\frac{1}{2} cosl$ $2 = f(1) = -\frac{1}{2} cosl$	$\sin(x^{2}+1) dx$ $du = 2x dx$ $\frac{1}{2} du = x dx$ $u) \cdot \frac{1}{2} du$ $\sin(u) du$ $\cos(u)) + C$ $\sin(x^{2}+1) + C$	U-Substitution · identify u and · simply to re · solve for new the original f(x)=-\frac{1}{2}cos(x^2)	nd its derivative du ceive direct substitution bounds by plugging in bounds into the u-equation
the point (1,2). ! We can not assume f(x) is linear so we use initial value rather than point - slope linear form! Initial Value Problem f(x) = S f'(x) dx 'solve for c using initial value	$f(x) = \int xs$ $u = x^{2} + 1$ $= \int sin l$ $= \frac{1}{2} \int si$ $= \frac{1}{2} \left(-c \right)$ $= -\frac{1}{2} co$ $= -\frac{1}{2} cosl$ $2 = f(1) = -\frac{1}{2} cosl$	$\sin(x^{2}+1) dx$ $du = 2x dx$ $\frac{1}{2} du = x dx$ $u) \cdot \frac{1}{2} du$ $\sin(u) du$ $\cos(u)) + C$ $\sin(x^{2}+1) + C$	U-Substitution identify u and simply to restant to solve for new the original	nd its derivative du ceive direct substitution bounds by plugging in bounds into the u-equation
the point (1,2). ! We can not assume $f(x)$ is linear so we use initial value rather than point - slope linear form! Initial Value Problem $f(x) = \int f'(x) dx$ solve for c using initial value 4. Evaluate $\int_0^1 \frac{x^2+2}{ x^3+6x+5 } dx$	$f(x) = \int xs$ $u = x^{2} + 1$ $= \int sin1$ $= \frac{1}{2} \int si$ $= \frac{1}{2} (-c)$ $= -\frac{1}{2} co$ $= -\frac{1}{2} cos$ $2 = f(1) = -$ $2 + \frac{1}{2} cos$ $\int_{0}^{1} (x^{3} + bx)^{4} dx$	$\sin(x^{2}+1) dx$ $du = 2x dx$ $\frac{1}{2} du = x dx$ $u) \cdot \frac{1}{2} du$ $\sin(u) du$ $\cos(u) + c$ $\sin(x^{2}+1) + c$ \sin	U-Substitution identify u and simply to resistant the original $f(x) = -\frac{1}{2}\cos(x^2)$	nd its derivative du ceive direct substitution s bounds by plugging in bounds into the u-equation 1) + ½ cos(5) +2 u''²]s
the point (1,2). ! We can not assume f(x) is linear so we use initial value rather than point-slope linear form! Initial Value Problem f(x)= S f'(x) dx solve for c using initial value 4. Evaluate $\int_0^1 \frac{x^2+2}{\sqrt{x^3+6x+5}} dx$ U-Substitution	$f(x) = \int xs$ $u = x^{2} + 1$ $= \int sin l$ $= \frac{1}{2} \int si$ $= \frac{1}{2} (-c)$ $= -\frac{1}{2} co$ $= -\frac{1}{2} cos$ $2 = f(1) = -$ $2 + \frac{1}{2} cos$ $U = x^{3} + lox$	$\sin(x^{2}+1) dx$ $du = 2x dx$ $\frac{1}{2} du = x dx$ $u) \cdot \frac{1}{2} du$ $\sin(u) du$ $\cos(u) + C$ $\sin(x^{2}+1) + C$ $\cos(x^{2}+1) + C$ $\sin(x^{2}+1) + C$ $\cos(x^{2}+1) + C$ $\sin(x^{2}+1) + C$ \sin	U-Substitution identify u and simply to restrict the original $\frac{1}{2}$ $\frac{1}{2} = \frac{1}{3} \left[\frac{1}{1/2} \right]$ $= \frac{1}{3} \left[\frac{1}{1/2} \right]$	nd its derivative du ceive direct substitution s bounds by plugging in bounds into the u-equation 1) + ½ cos(s) + 2 u''^2]_5^{12} u''^2]_5^{12}
the point (1,2). ! We can not assume f(x) is linear so we use initial value rather than point-slope linear form! Initial Value Problem f(x) = S f'(x) dx solve for c using initial value 4. Evaluate So $\frac{x^2+2}{\sqrt{x^3+4x^2+5}}$ dx U-Substitution identify u and its derivative du	$f(x) = \int xs$ $u = x^{2} + 1$ $= \int sin l$ $= \frac{1}{2} \int si$ $= \frac{1}{2} (-c)$ $= -\frac{1}{2} co$ $= -\frac{1}{2} cos$ $2 = f(1) = -$ $2 + \frac{1}{2} cos$ $3 - \frac{1}{2} cos$ $4 - \frac{1}{2} cos$	$\sin(x^2+1) dx$ $du = 2x dx$ $\frac{1}{2} du = x dx$ $u) \cdot \frac{1}{2} du$ $\sin(u) du$ $\cos(u) + c$ $\sin(x^2+1) + c$ $\cos(x^2+1) + c$ $\cos(x^2+1)$	U-Substitution identify u and simply to restrict the original state of the original sta	on nd its derivative du ceive direct substitution bounds by plugging in bounds into the u-equation 1) + ½ cos(5) + 2 u''²]'² 1/2] ¹² 1/2] ²² 1/2
the point (1,2). ! We can not assume f(x) is linear so we use initial value rather than point-slope linear form! Initial Value Problem f(x) = S f'(x) dx 'solve for c using initial value initial value 4. Evaluate So x²+2	$f(x) = \int xs$ $u = x^{2} + 1$ $= \int sin l$ $= \frac{1}{2} \int si$ $= \frac{1}{2} (-c)$ $= -\frac{1}{2} co$ $= -\frac{1}{2} cos$ $2 = f(1) = -$ $2 + \frac{1}{2} cos$ $u = x^{3} + lox$ $du = (3x^{2} + lox)$ $du = (3x^{2} + lox)$ $\frac{1}{3} du = (x^{2} + lox)$	$\sin(x^{2}+1) dx$ $du = 2x dx$ $\frac{1}{2} du = x dx$ $u) \cdot \frac{1}{2} du$ $\sin(u) du$ $\cos(u) + C$ $\sin(x^{2}+1) + C$ $\cos(x^{2}+1) + C$ $\sin(x^{2}+1) + C$ $\cos(x^{2}+1) + C$ \cos	U-Substitution identify u and simply to restrict the original state of the original sta	nd its derivative du ceive direct substitution bounds by plugging in bounds into the u-equati 1) + ½ cos(5) + 2 u''²]'² u²]'² u²]'² u²] '²
! We can not assume f(x) is linear so we use initial value rather than point-slope linear form! Initial Value Problem f(x)= Sf'(x) dx solve for c using initial value 4. Evaluate So x2+2 / x2+0x+5 dx U-Substitution identify u and its derivative du simply to receive direct substitution solve for new bounds by plugging	$f(x) = \int xs$ $u = x^{2} + 1$ $= \int sin l$ $= \frac{1}{2} \int si$ $= \frac{1}{2} (-c)$ $= -\frac{1}{2} co$ $= -\frac{1}{2} cos$ $2 = f(1) = -$ $2 + \frac{1}{2} cos$ $u = x^{3} + lox$ $du = (3x^{2} + lox)$ $du = (3x^{2} + lox)$ $\frac{1}{3} du = (x^{2} + lox)$ $\frac{1}{3} du = (x^{2} + lox)$ $\frac{1}{3} du = (x^{2} + lox)$	$\sin(x^{2}+1) dx$ $du = 2x dx$ $\frac{1}{2} du = x dx$ $u) \cdot \frac{1}{2} du$ $\sin(u) du$ $\cos(u) + C$ $\sin(x^{2}+1) + C$ \sin	U-Substitution identify u and simply to restrict the original state of the original sta	on nd its derivative du ceive direct substitution bounds by plugging in bounds into the u-equati 1) + ½ cos(s) +2 u''²]'s 112]'² 112]'² 123 - (5)''²)] 121 - (5)] 2 131 - (51)]
the point (1,2). ! We can not assume f(x) is linear so we use initial value rather than point-slope linear form! Initial Value Problem f(x) = S f'(x) dx solve for c using initial value 4. Evaluate So x²+2	$f(x) = \int xs$ $u = x^{2} + 1$ $= \int sin l$ $= \frac{1}{2} \int si$ $= \frac{1}{2} (-c)$ $= -\frac{1}{2} (-c)$ $= -\frac{1}{2} cos$ $2 = f(1) = -$ $2 + \frac{1}{2} cosl$ $3 - \frac{1}{2} cosl$ $4 = x^{3} + lox$ $4 = x^{3} + lox$ $4 = x^{3} + lox$ $5 = x^{2} + lox$ $4 = x^{3} + lox$ $5 = x^{2} + lox$ $6 = x^{2} + lox$ $6 = x^{3} + lox$ $7 = x^{3} + lox$ $8 = x^{3} + lox$ $1 = x^{3} + lox$ $2 = x^{3} + lox$ $3 = x^{3} + lox$ $4 = x^{3} + lox$ $5 = x^{3} + lox$ $6 = x^{3} + lox$ $1 = x^{3} + lox$ $1 = x^{3} + lox$ $2 = x^{3} + lox$ $3 = x^{3} + lox$ $4 = x^{3} + lox$ $3 = x^{3} + lox$ $4 = x^{3} + lox$ $3 = x^{3} + lox$ $4 = x^{3} + lox$ $3 = x^{3} + lox$ $4 = x^{3} + lox$ $3 = x^{3} + lox$ $4 = x^{3} + lox$ $5 = x^{3} + lox$ $7 = x^{3} + lox$ $8 = x^{3$	$\sin(x^{2}+1) dx$ $du = 2x dx$ $\frac{1}{2} du = x dx$ $u) \cdot \frac{1}{2} du$ $\sin(u) du$ $\cos(u) + C$ $\sin(x^{2}+1) + C$ \sin	U-Substitution identify u and simply to restrict the original state of the original sta	on nd its derivative du ceive direct substitution bounds by plugging in bounds into the u-equation 1) + ½ cos(5) +2 u''²]'² u''²] u''²]'² u''²] u''] u'