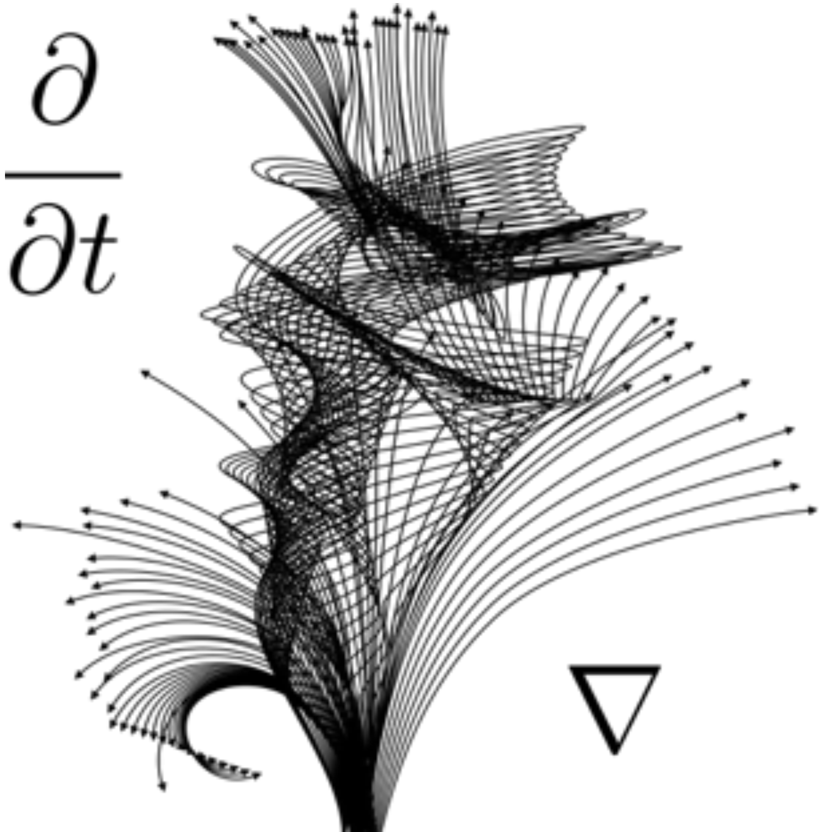
Differential Calculus with Applications to Life Sciences

Math 102:105

Pooya Ronagh

Agenda for today:

- Linear approximation
- Derivatives (spreadsheet)
- Newton's method (spreadsheet)
- Antiderivatives

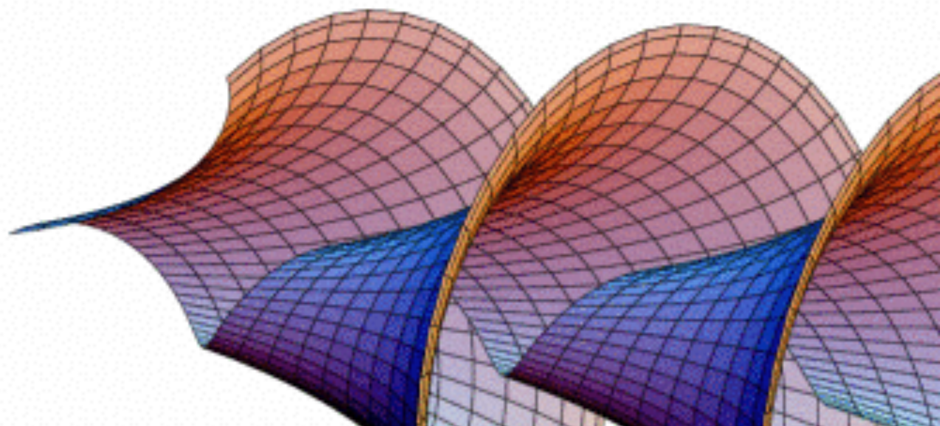


Last time: Equation of tangent line

Given $y = f(x)$ find $y = mx + b$ as equation of tangent line

- slope of the tangent line at x = a is $f'(a)$
- so far: $y = f'(a)x + b$
- Find b such that (a, f'(a)) is on the line

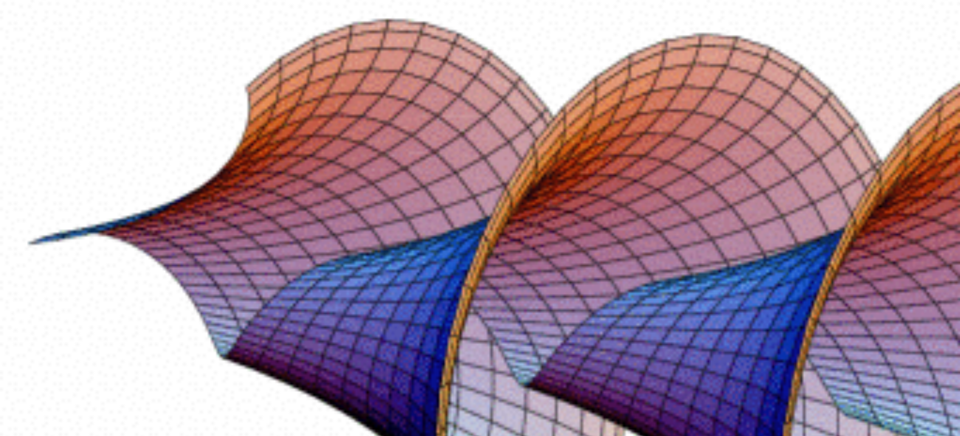
$$y = f'(a)x + [f(a) - af'(a)]$$



Another way to write this

$$y = f(x_0) + f'(x)(x - x_0)$$

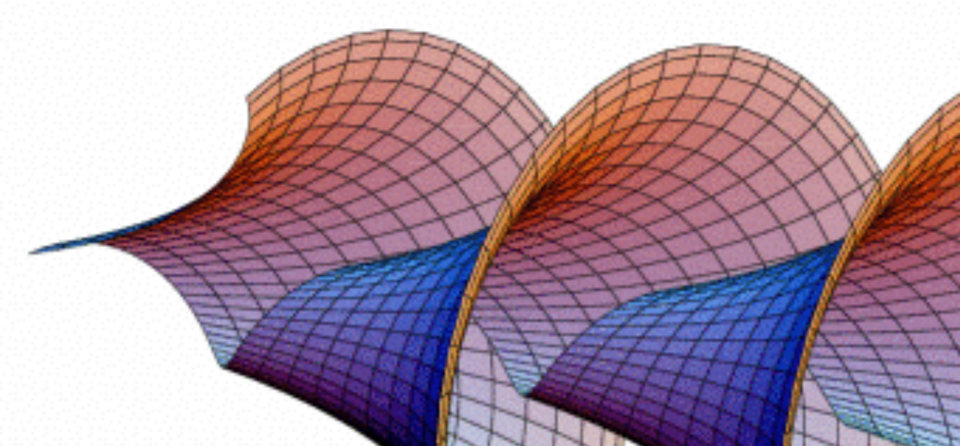
Specially useful for **linear approximations**.



Example

$$y = f(x_0) + f'(x)(x - x_0)$$

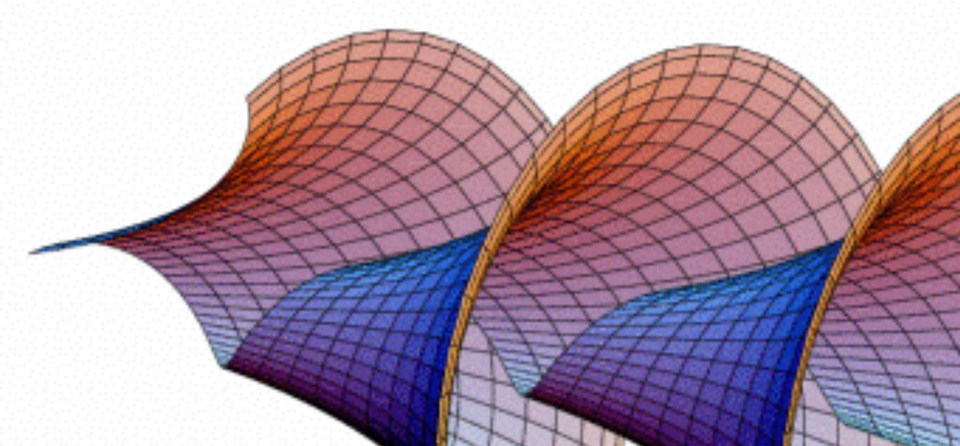
Use this formula to approximate (1.03)^(1/3)



Question

Which one is an approximation to sin(3) ?

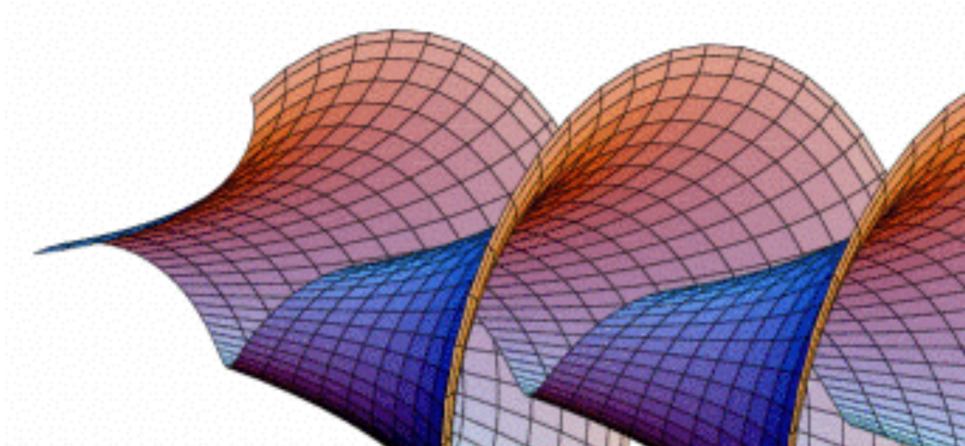
(A) 0
(B) pi
(C) 3
(D) 0.14159
(E) Don’t know



Sketching derivative using spreadsheet

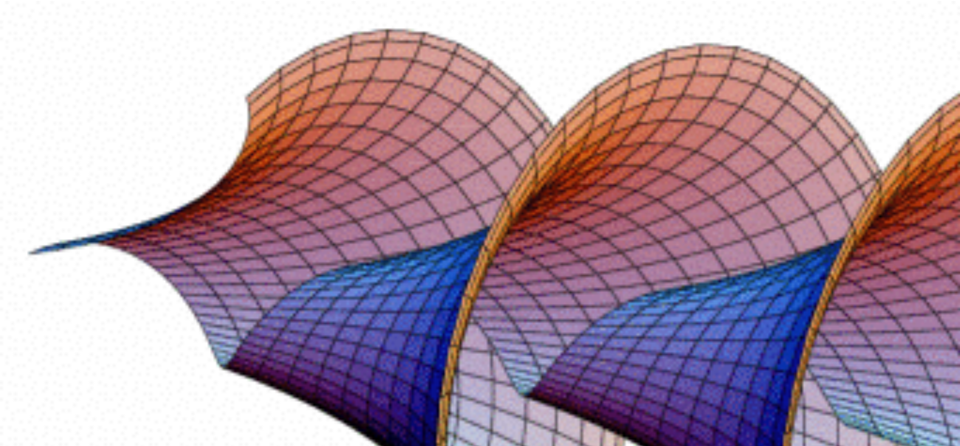
$$f(x) = \sin(x)$$

$$f(x) = x\sin(x)$$



Newton's method using spreadsheets

$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$$



Antiderivative

If

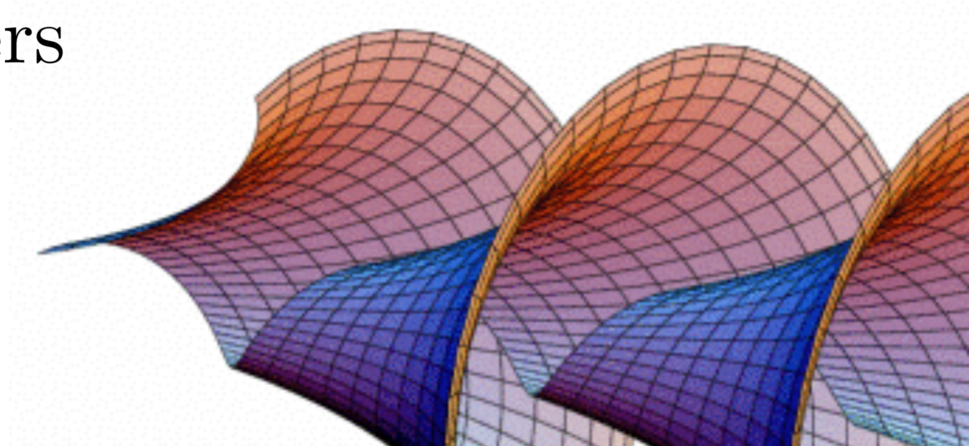
$$f'(x) = 6x^2 + 2x$$

Then f(x) is given by:

$$(A) \quad f'(x) = 2x^3 + x^2 + 1 \qquad (B) \quad f'(x) = 6x^3 + 2x^2$$

$$(C) \quad f'(x) = 2x^3 + x^2 - 10 \qquad (D) \quad f'(x) = 2x^3 + x^2 - 37$$

$$(E) \quad \text{could have infinity many answers}$$

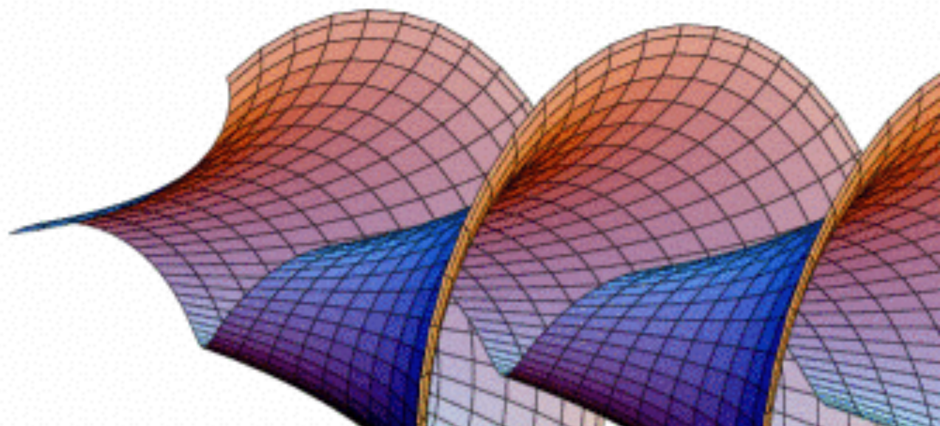


Last rule of derivate: chain rule

But before that: **composition of functions**

If f(x) = 2x + 3 and g(x) = -4x + 2 what is f(g(x))?

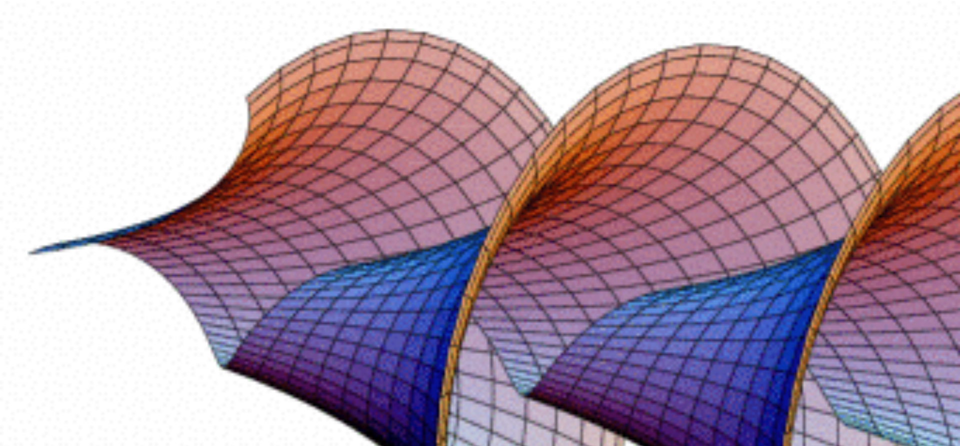
(A) -8x +7
(B) -8x + 10
(C) -8x^2-8x+6
(D) -8x+5



Chain rule= derivative of a composition

Composition: **o** notation

$$f(g(x)) = f'(g(x))g'(x)$$



See you on Thursday!

And don’t forget these due dates:

WW3: Sept 29
OSH2: Sept 30
PL5.1: Oct 3