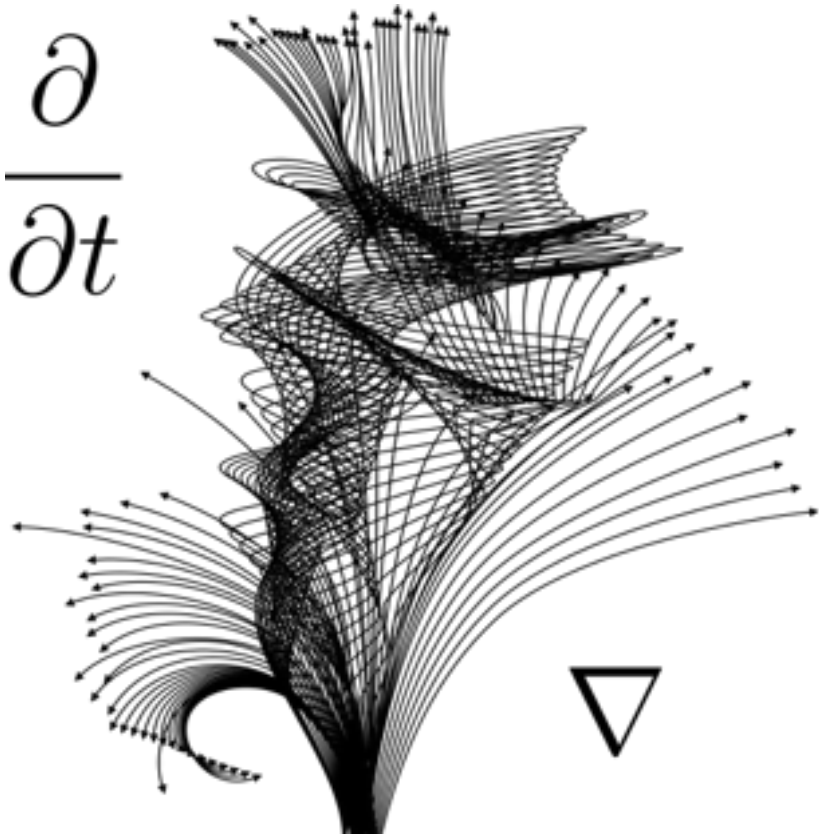
Differential Calculus with Applications to Life Sciences

Math 102:105

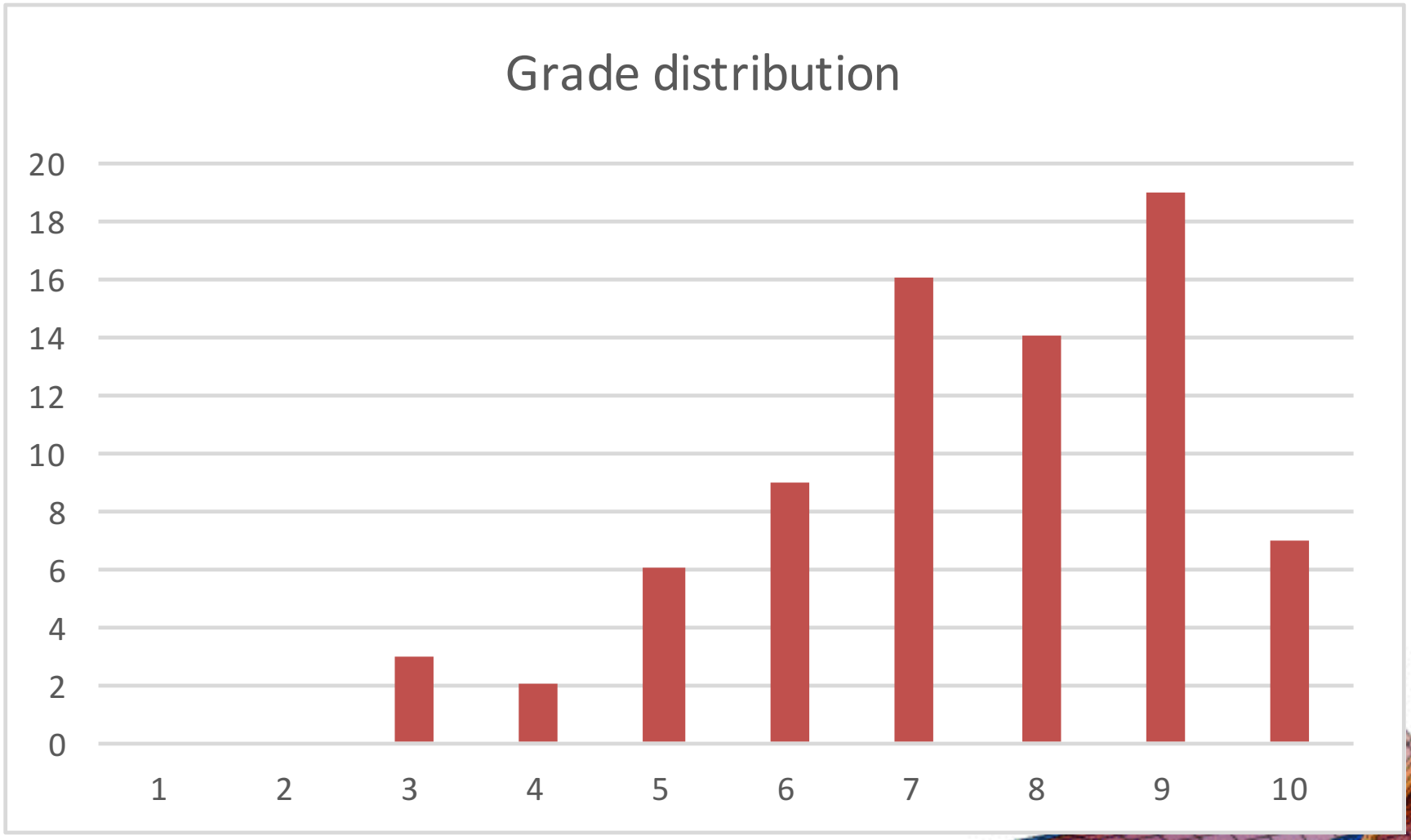
Pooya Ronagh

Agenda for today:

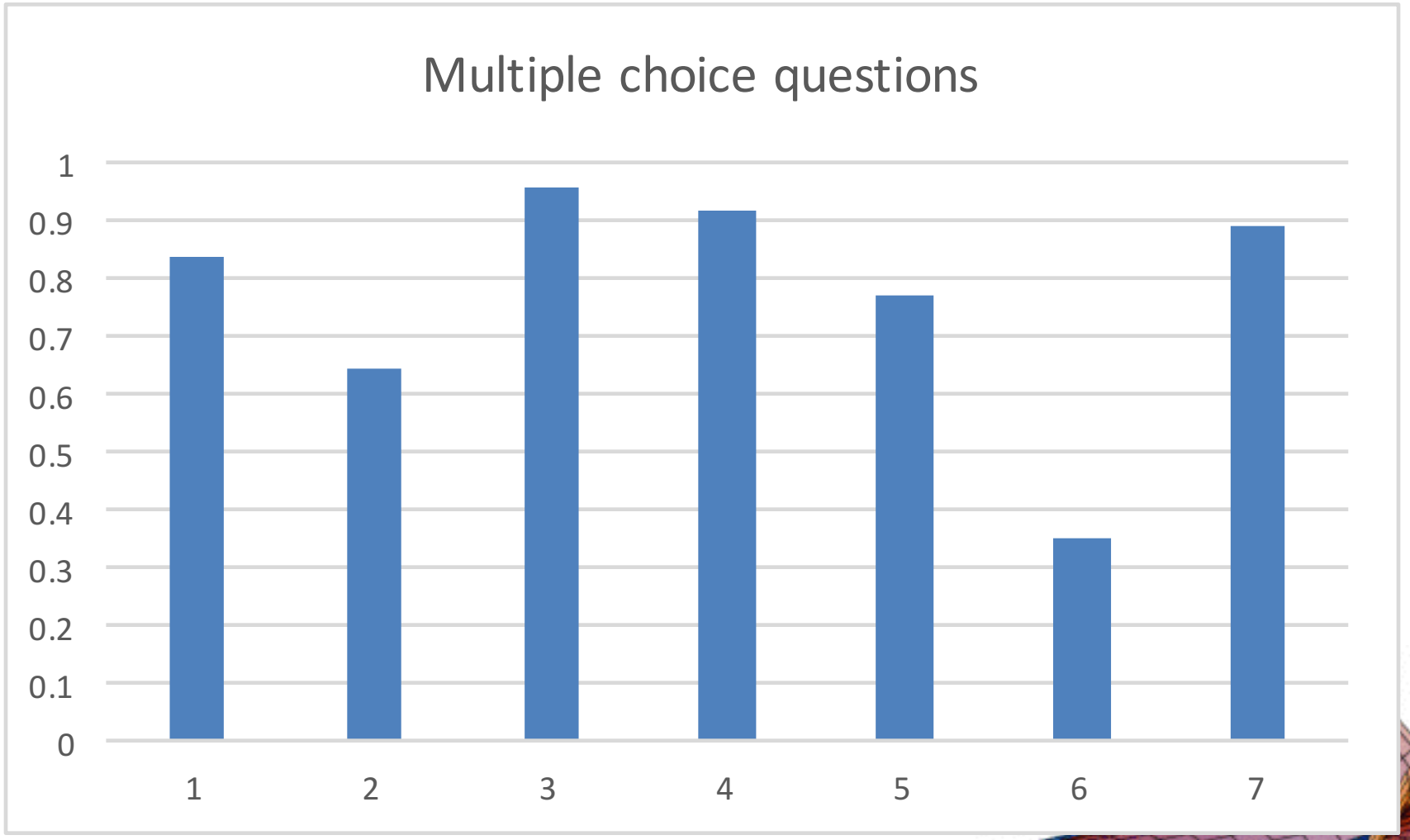
- Quotient rule
- Linearity of derivative
- Equation of the tangent line
- Antiderivatives
- Intro to Newton's method



Quiz



Quiz


Multiple choice questions
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
2
3
4
5
6
7

Last time…

Rules of derivation

- power rule

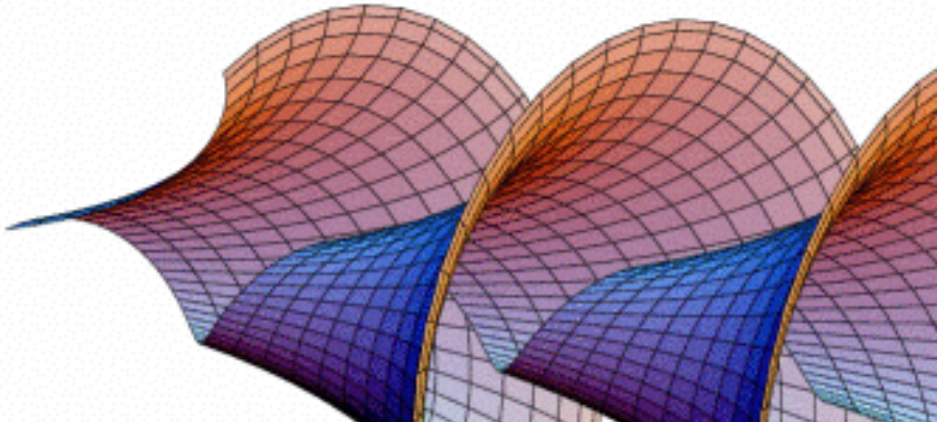
$$f(x) = x^n$$
$$f'(x) = nx^{n-1}$$

- sum rule

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

- product rule

$$(fg)' = f'g + fg'$$



Linearity

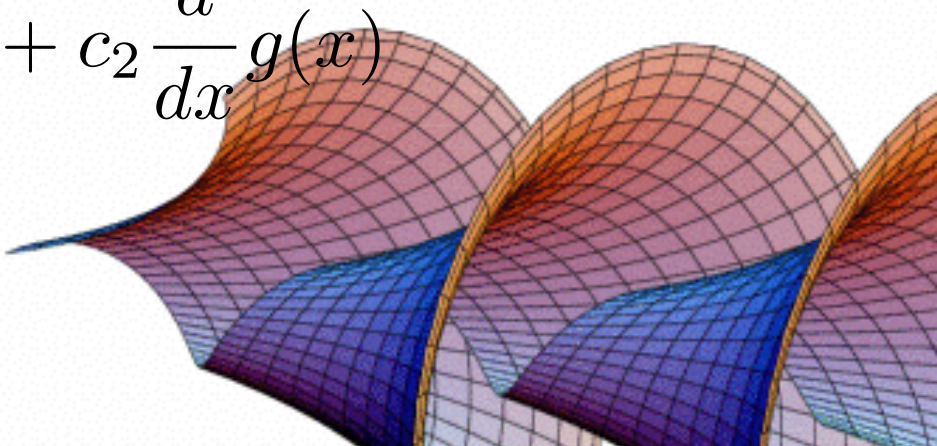
The last three create a property called **linearity**:

$$\frac{d}{dx}(f(x)+g(x)) = \frac{d}{dx}f(x) + \frac{d}{dx}g(x)$$

$$\frac{d}{dx}(cf(x)) = c\frac{d}{dx}f(x)$$

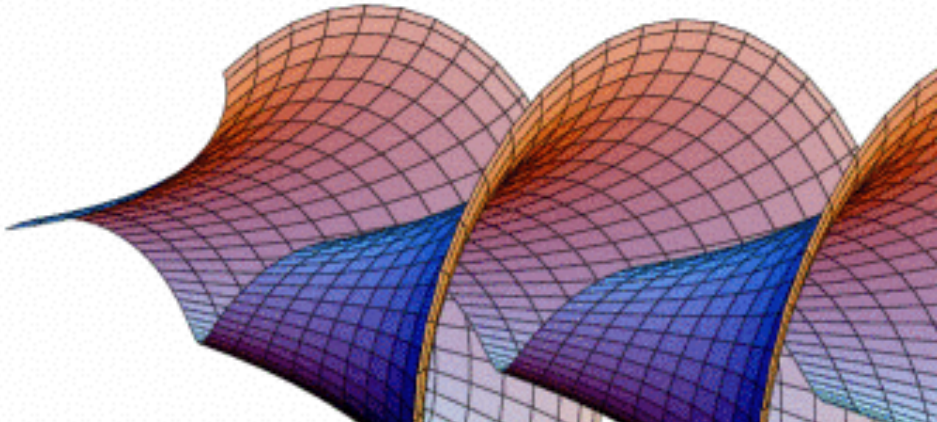
Or combined to:

$$\frac{d}{dx}(c_1 f(x) + c_2(x)) = c_1\frac{d}{dx}f(x) + c_2\frac{d}{dx}g(x)$$



Examples

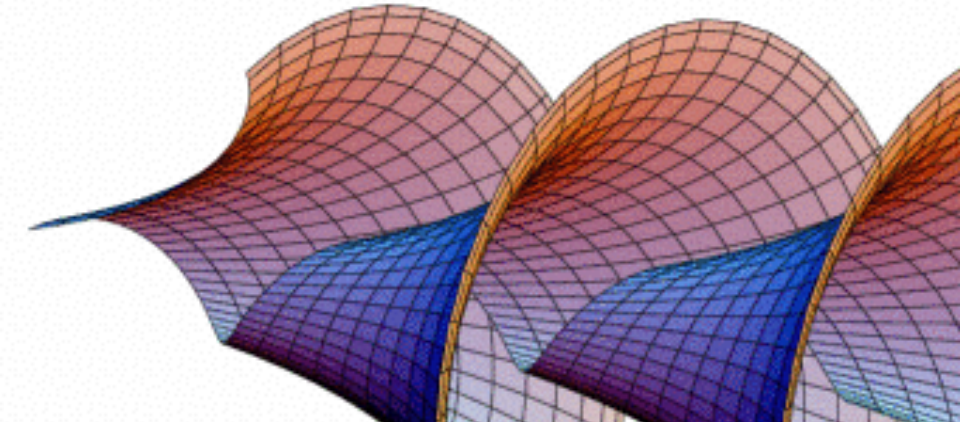
Polynomials!



Product rule

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

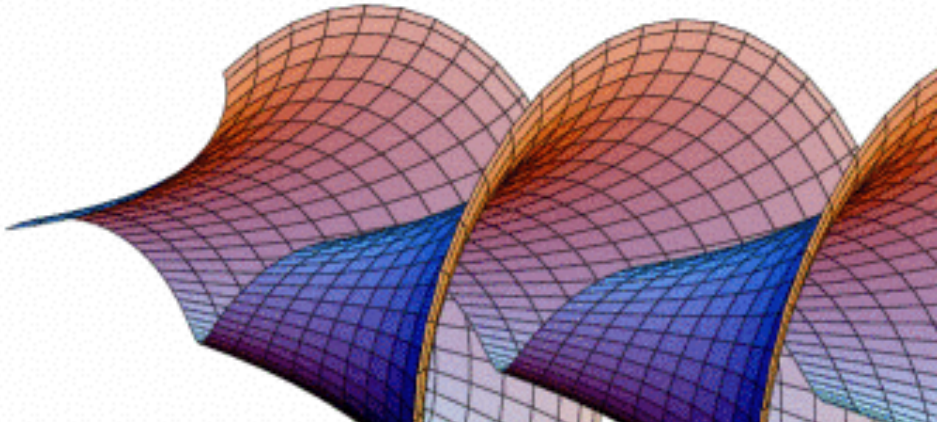
Example: find derivative of 5 x sin (x).



Quotient rule

$$\left(\frac{f(x)}{g(x)}\right)' = \frac{f'(x)g(x) - g'(x)f(x)}{g(x)^2}$$

$$\left(\frac{u}{v}\right)' = \frac{u'v - v'u}{v^2}$$



Quotient rule

Suppose f(x) = g(x) / k (x) and that

g(2) = 3, k(2) = 1, g’(2) = 2, k’(2) = 5

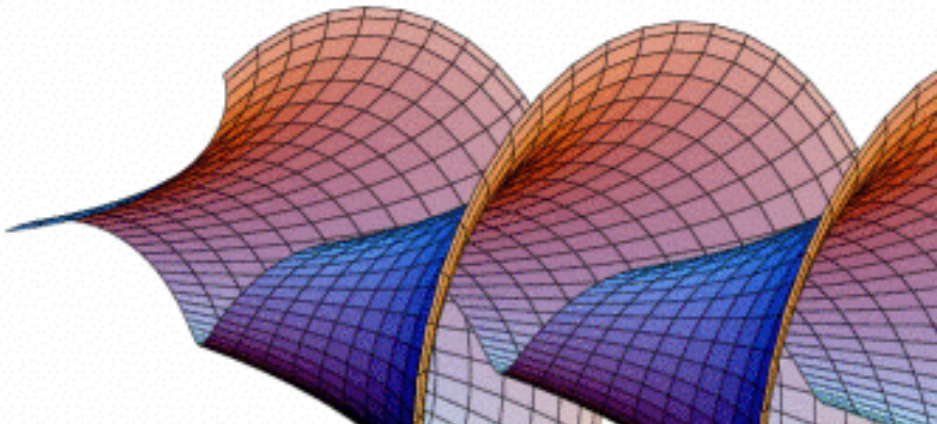
What is f’(2)?

(A) -13

(B) -13/25

(C) -13/9

(D) 17/25



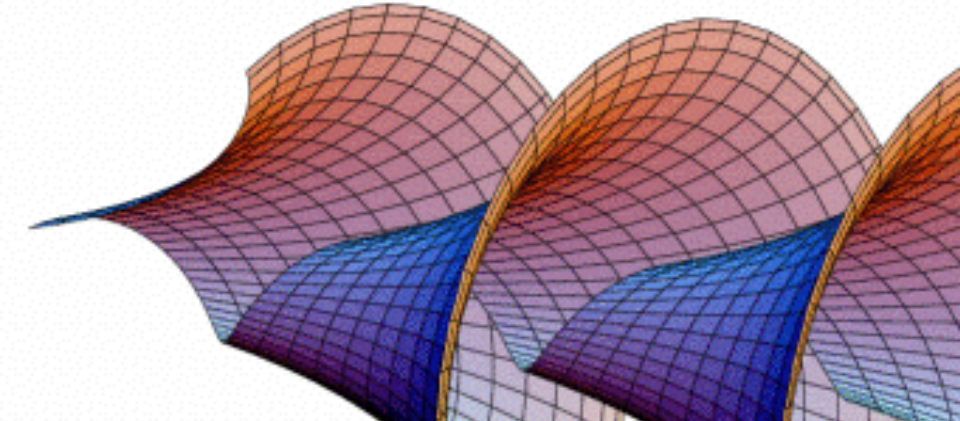
Another example

Find derivative of f(x) = 1/x using

(a) definition of the derivative

(b) using the power rule

(c) using the quotient rule

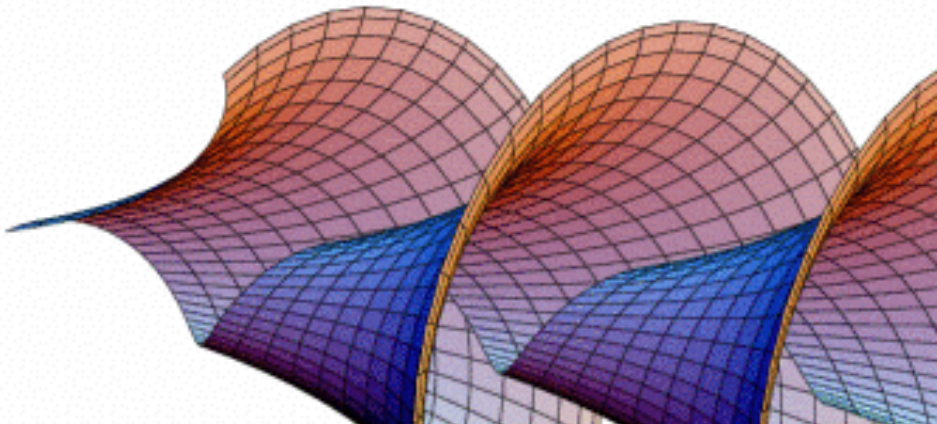


Equation of the tangent line

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

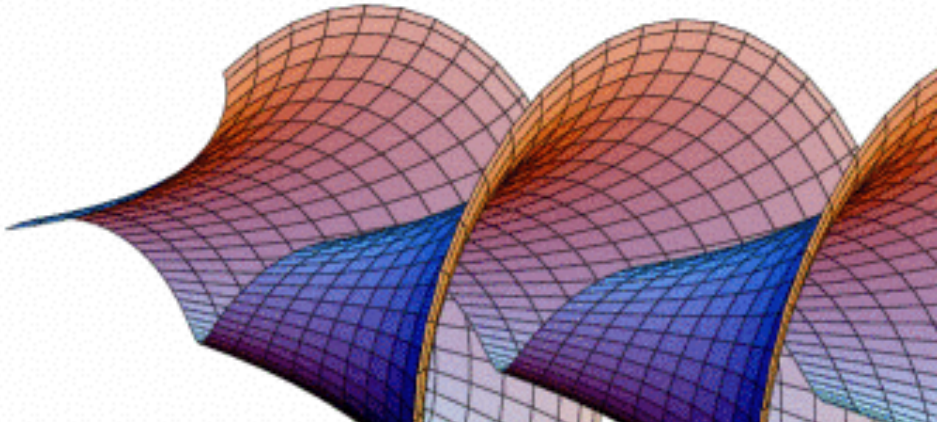
- slope of the tangent line at x = a is $f'(a)$
- so far: $y = f'(a)x + b$
- Find b such that (a, f'(a)) is on the line

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



Newton's method

$$a_{n+1} = a_n - \frac{f(a_n)}{f'(a_n)}$$



Antiderivative

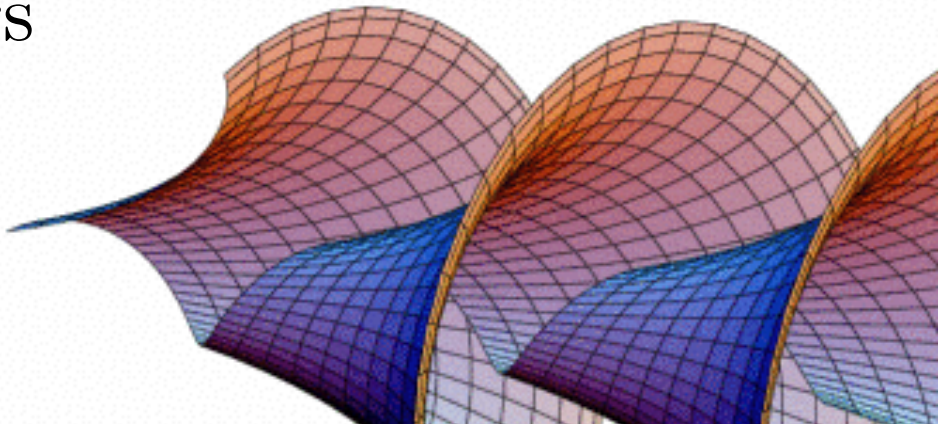
If $$f'(x) = 6x^2 + 2x$$

Then f(x) is given by:

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

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

(E) could have infinity many answers



See you on Thursday!

And don’t forget these due dates:

PL4.2: Sept 28
WW3: Sept 29
OSH2: Sept 30