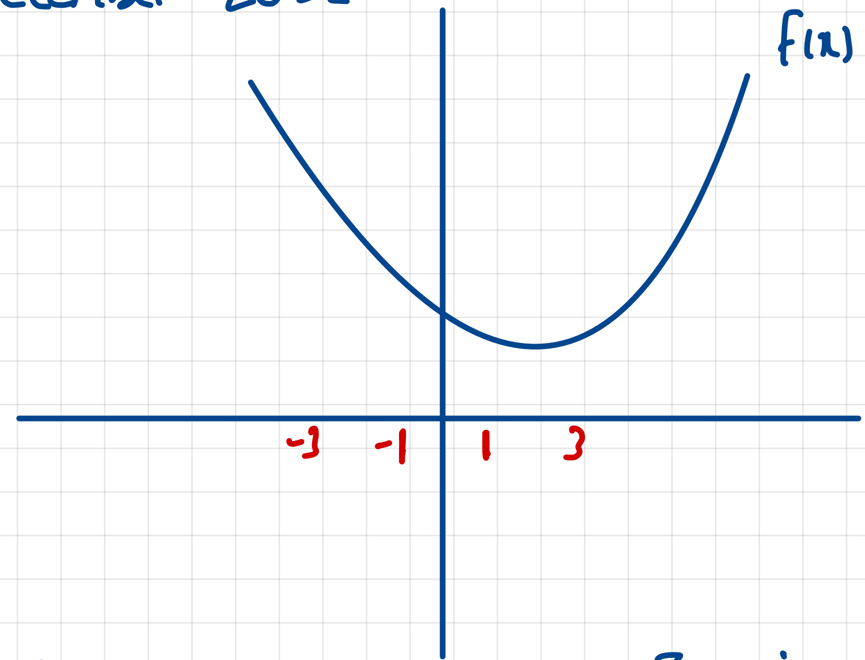
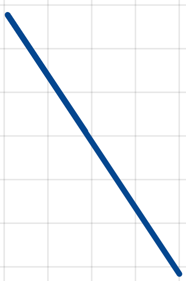
6 December 2022



x	gradient
-1	-1
-3	-1.5
2	0
4	1

$x=2$ f(x) is a minimum
tangent line is
horizontal

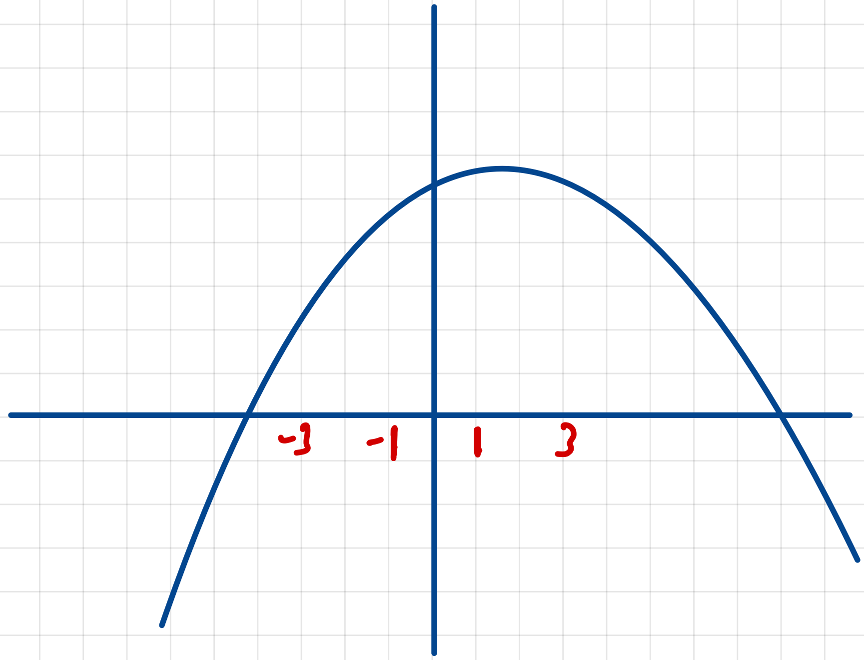
F(x) is increasing
when $x>2$ tangent line is
positive



F(x) <2
F(x) is decreasing
tangent line is
negative

Q1

$F(2)$



$x=2$ $f(x)$ is a maxima

tangent line $=0$

$f(x)<2$

$f(x)$ is increasing

tangent line is positive

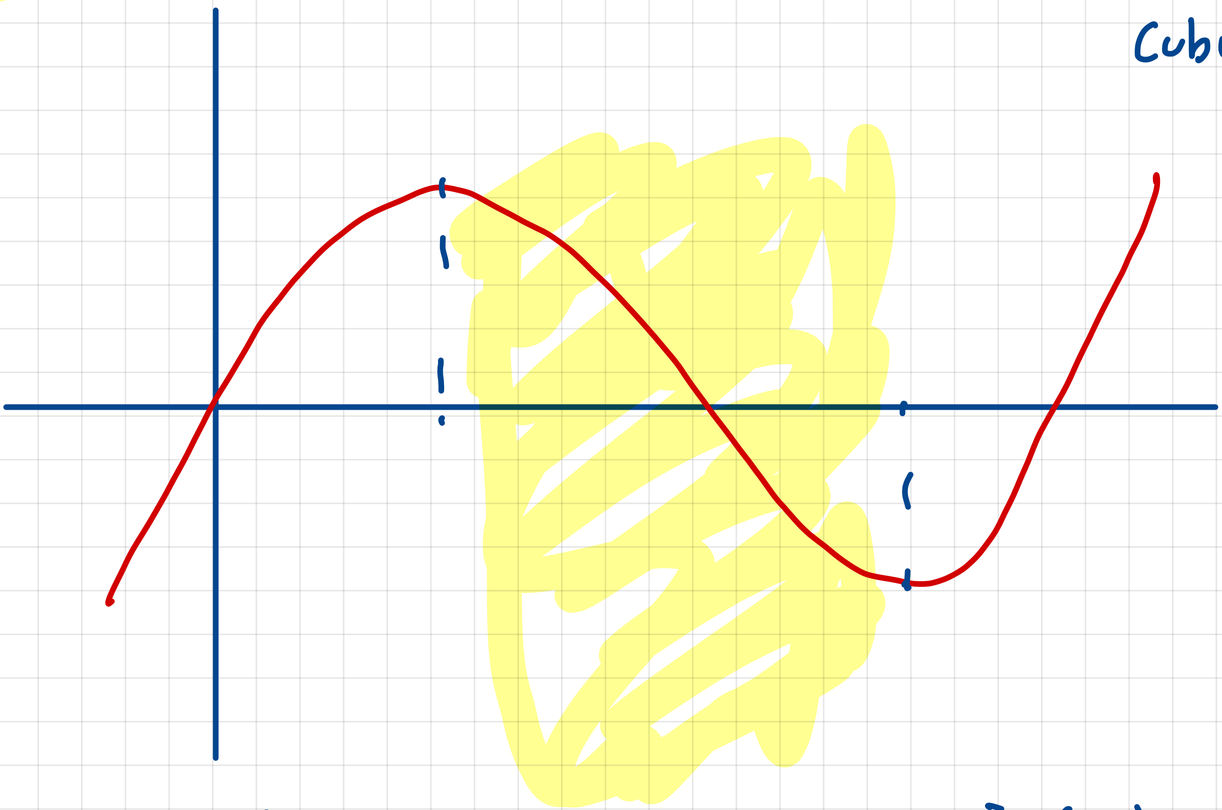
$x>2$ $f(x)$ is decreasing

tangent line is negative

tangent line gradient (x)

Q2

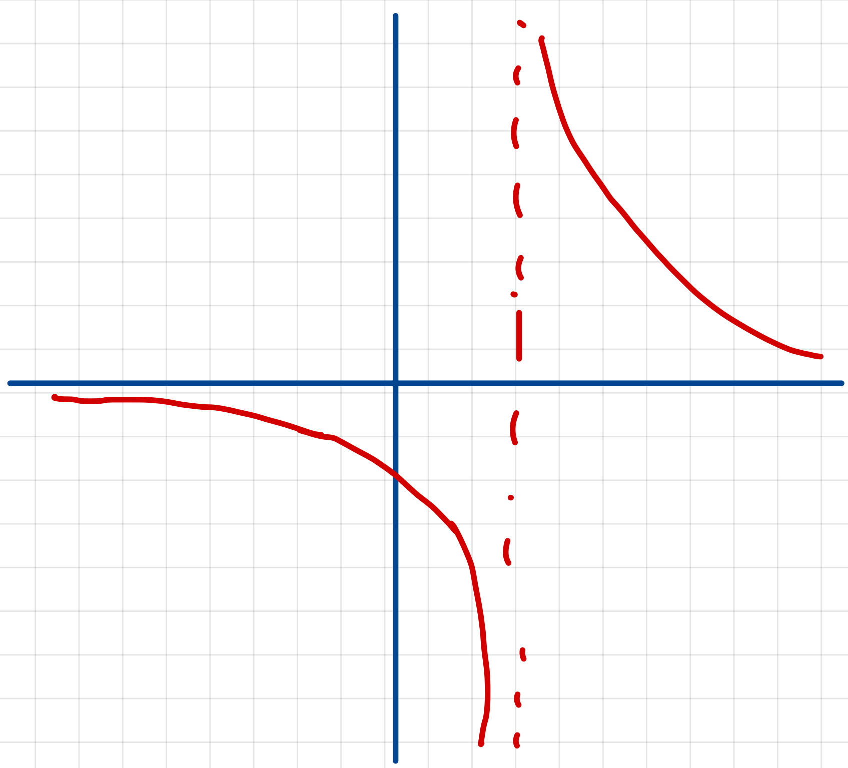
Cubic function

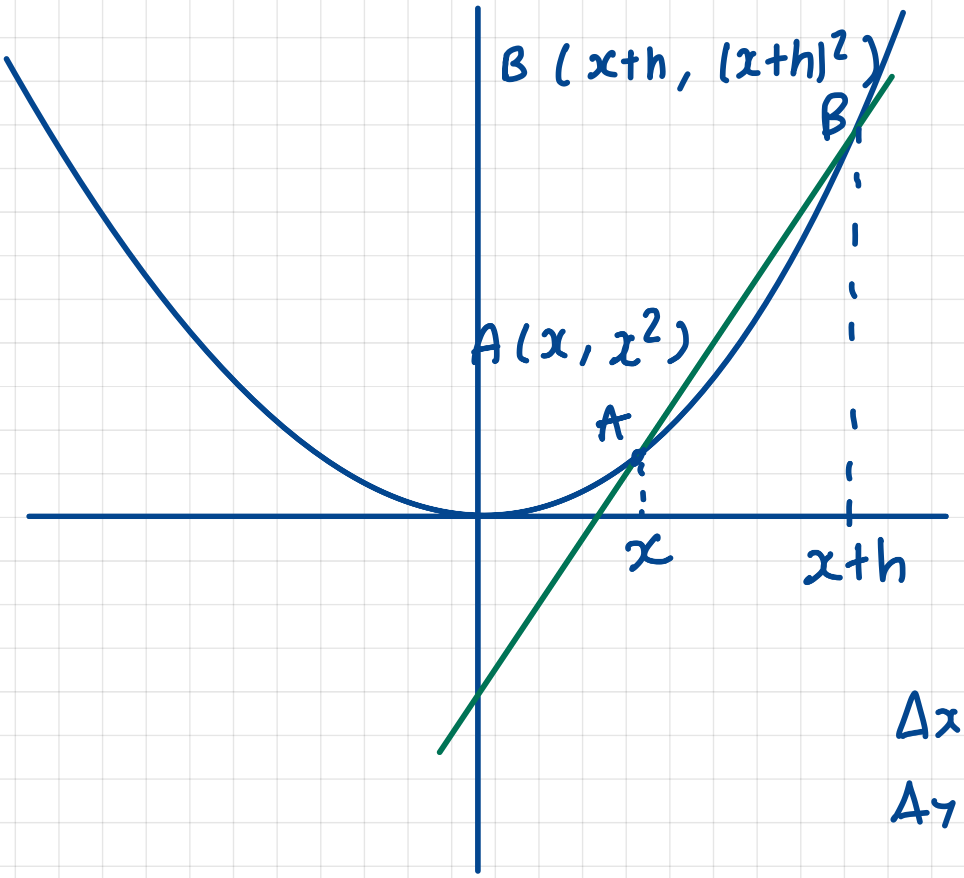


increasing

decreasing

increasing





$F(x) = x^2$

green line secant line, crosses $F(x)$

m is gradient of the line

Δx change in x

Δy change in y

$$m(x) = \frac{\text{RISE}}{\text{RUN}} = \frac{\Delta y}{\Delta x}$$

$$m(x) = \frac{f(x+h) - f(x)}{(x+h) - x} = \frac{(x+h)^2 - x^2}{h}$$

$$m(x) = \frac{\cancel{x^2} + 2xh + h^2 - \cancel{x^2}}{h} = \frac{2xh + h^2}{h}$$

h=0 get $\frac{0}{0}$

$$m(x) = \frac{\cancel{h}(2x+h)}{\cancel{h}} = 2x+h$$

$$m(x)_{h \to 0} = 2x$$

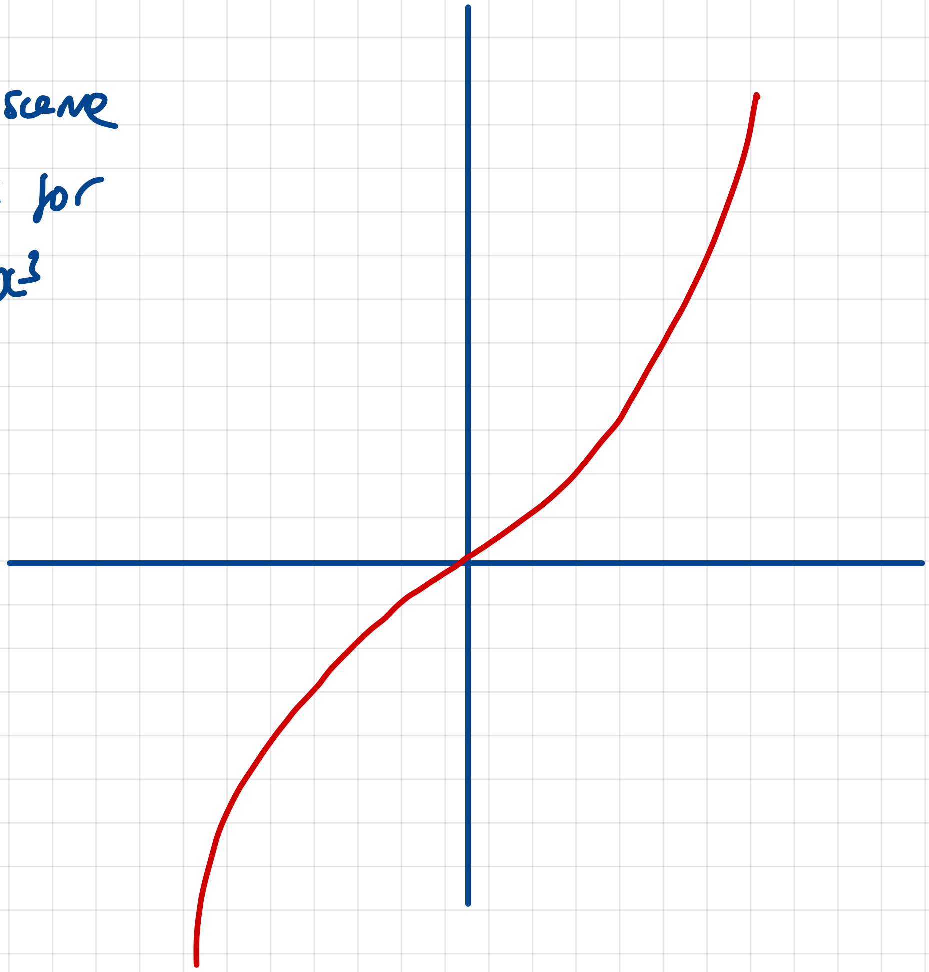
taking the limit

move B → A

Q1

$f(x) = x^3$

do the same analysis for $f(x) = x^3$



$f(x) = x^n$ $\quad n = 4, 5 \ldots$

$(x+h)^n$ pascals triangle

$(x+h)^0 = 1$

$(x+h)^1 = x+h$

$(x+h)^2 = x^2 + 2xh + h^2$

$(x+h)^3 = (x+h)(x^2 + 2xh + h^2)$

$= x^3 + 3x^2h + 3xh^2 + h^2$

$(x+h)^4 = (x+h)(x^3 + 3x^2h + 3xh^2 + h^2)$

$= x^4 + 4x^3h + 6x^2h^2 + 4xh^3 + h^4$

1
1 1
1 2 1
1 3 3 1
1 4 6 4 1