Period 3, March 12, 2025

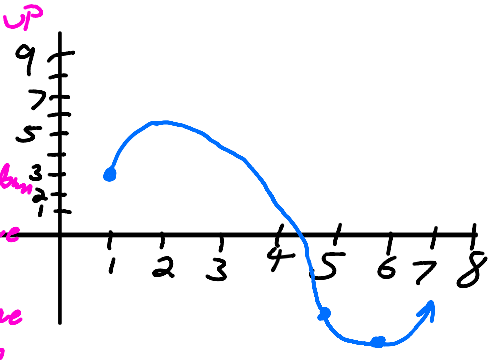
$F(1)=3$

$F'(x)>0$ $(1,2)(6,7)$ going up

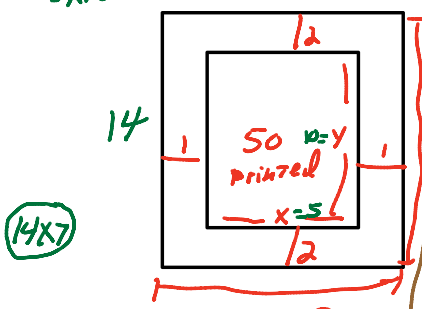
$F'(x)<0$ $(2,6)$ = going down

$F''(x)>0$ $(5,7)$ = concave up

$F''(x)<0$ $(1,5)$ - concave Down



5x10



(14x7)

$x \cdot y = 50 \Rightarrow y = \frac{50}{x}$

Area of paper $= A = (y+4)(x+2)$

Max/min $\frac{dA}{dx} = 0$

$A = \left(\frac{50}{x}+4\right)(x+2)$

$A = \frac{50}{x}\cdot x + 2\cdot\frac{50}{x} + 4x + 8$

$A = 50 + 100x^{-1} + 4x + 8$

$\frac{dA}{dx} = 0 - 100x^{-2} + 4 + 0$

$0 = -\frac{100}{x^2} + 4$

$4 \cdot \frac{100}{x^2} = 4 \cdot x^2$

$\frac{100}{4} = \frac{4x^2}{4}$

$25 = x^2$

$5 = x$

$y = \frac{50}{x} = \frac{50}{5} = 10$

$x \cdot y = 32 \Rightarrow x = \frac{32}{y}$

$A = (y+4)(x+2)$

$A = (y+4)\left(\frac{32}{y}+2\right)$

$A = x\cdot\frac{32}{y} + 2y + \frac{128}{y} + 8$

$A = 32 + 2y + 128y^{-1} + 8$

$\frac{dA}{dy} = 0 + 2 + -128y^{-2} + 0$

$0 = 2 - \frac{128}{y^2} \Rightarrow \frac{128}{y^2} = 2 \Rightarrow y^2$

$\frac{128}{2} = \frac{2y^2}{2}$

$64 = y^2$ $\quad x = \frac{32}{y}$

$8 = y \Rightarrow x = \frac{32}{8} = 4$

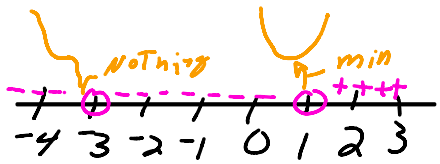
Dimensions 6×12

$4+2=6$

$8+4=12$

$F'(x) = (x-1)(x+3)^2$

$F'(x) = 0 \quad x = 1 \text{ or } x = -3$



$F'(-4) = (-4-1)(-4+3)^2$ Always +

$F'(0) = (0-1)(0+3)^2$ $= - \cdot +$

$F'(3) = (3-1)(3+3)^2 = + \cdot +$

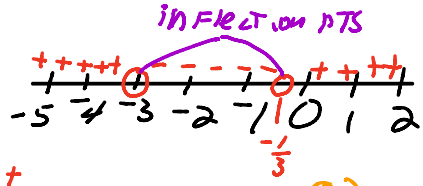
$F''(x) = 1\cdot(x+3)^2 + (x-1)(2(x+3)^1 \cdot 1)$

$= (x+3)\left[(x+3) + (x-1)\cdot 2\right]$

$(x+3)\left[x+3+2x-2\right]$

$F''(x) = (x+3)(3x+1)$

$F''(x) = 0 \quad x = -3 \text{ or } x = -\frac{1}{3}$



$F''(-4) = (-4+3)(3\cdot -4+1) = - \cdot - = +$

$F''(-1) = (-1+3)(3\cdot -1+1) = + \cdot - = -$

$F''(0) = (0+3)(0\cdot 3+1) = + \cdot + = +$

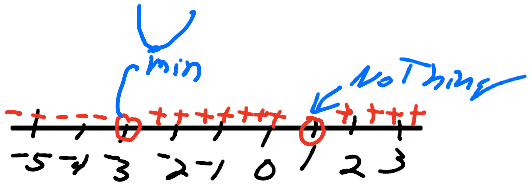
(a) $\emptyset$

(b) $x = 1$

(c) $x = -3$ and $x = -\frac{1}{3}$

$F'(x) = (x-1)^2(x+3)$

$F'(x) = 0$ when $x = 1$ or $x = -3$



$F'(-5) = (-5-1)^2(-5+3) = + \cdot - 2 = -$

$F'(0) = (0-1)^2(0+3) = + \cdot + = +$

$F'(2) = (2-1)^2(2+3) = + \cdot + = +$

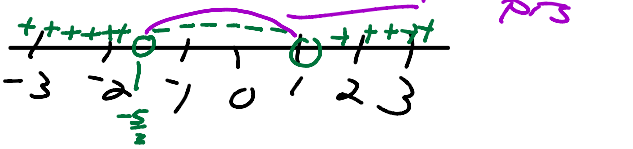
$F''(x) = 2(x-1)^1 \cdot 1\,(x+3) + (x-1)^2 \cdot 1$

$F''(x) = (x-1)\left[2(x+3) + (x-1)\right]$

$F''(x) = (x-1)\left[2x+6+x-1\right]$

$F''(x) = (x-1)(3x+5)$

$F''(x) = 0$ when $x = 1$ or $-\frac{5}{3}$



$F''(-2) = (-2-1)(3(-2)+5) = - \cdot - = +$

$F''(0) = (0-1)(3(0)+5) = - \cdot + = -$

$F''(2) = (2-1)(3(2)+5) = + \cdot + = +$

$F'(x) > 0$ all x — increasing

$F''(x) < 0$ all x — increasing at Slower Rate

x	y
-1	4
0	3
1	1

going down

x	y	
-1	4	+1
0	5	+1
1	6	

x	y	
-1	4	+1
0	5	+2
1	7	

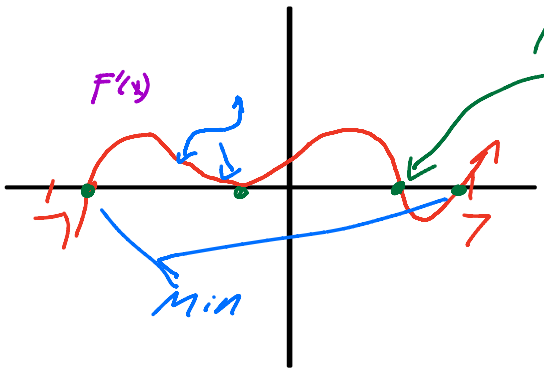
$F'(x) = +$

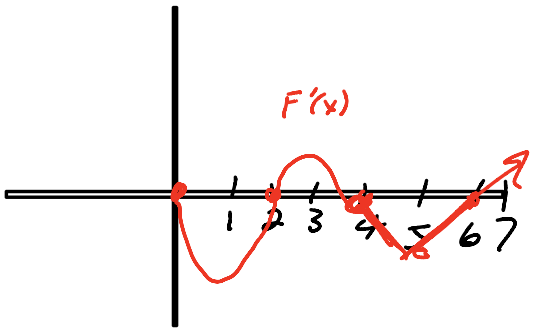
x	y	
-1	4	+2
0	6	+1
1	7	

$F'(x)$ has 4 zeros

Max $\Rightarrow F'(x)$ = Slope From + TO −

∩ One





When is F(x) decreasing

/

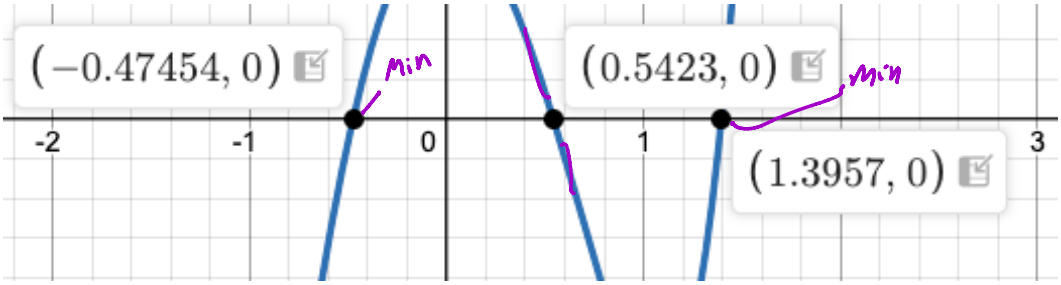
$F'(x) = -$

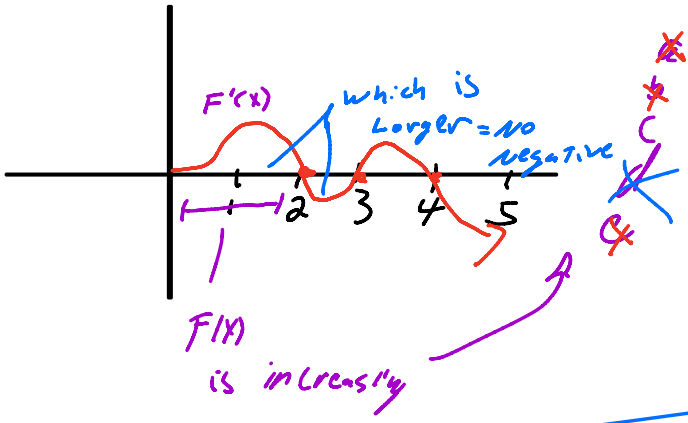
$(0,2) \cup (4,6)$

$F'(x) = x^3 - 4\sin(x^3) + 1$

Max of F(x) => From + TO -

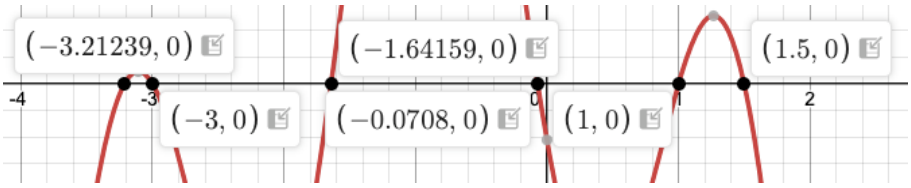
(0.5423



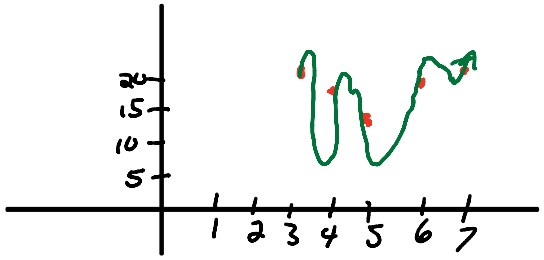


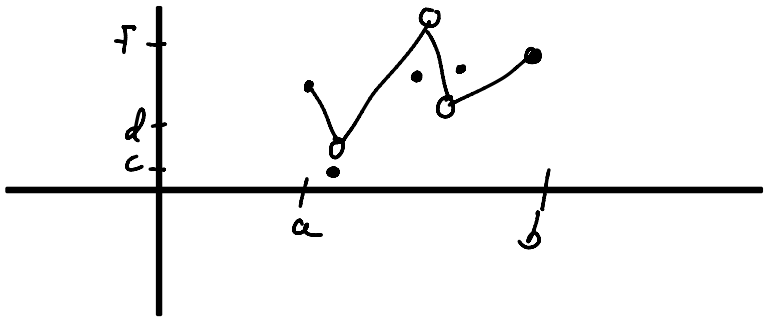
$F'(x) = (3 - 2x - x^2)\sin(2x - 3)$

6.



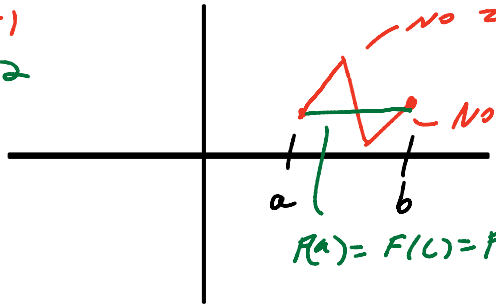
X	3	4	5	6	7
Y	20	17	12	16	20

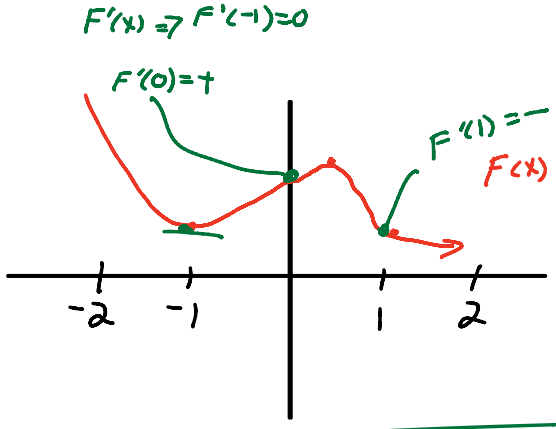




Example #1

Example #2





$F'(1) < F'(-1) < F'(0)$

$-\quad 0 \quad +$

$F(x) = x^3 - x + 2$

$F(2) = 2^3 - 2 + 2 = 8$

$(2, 8)$

$F(1.9) \approx 6.9$

$-.1$ $\quad -1.1 \Rightarrow 6.9$

1.9 $\quad 1.9$ From $2 = -0.1$

$y = x^3 - x + 2$

$\frac{dy}{dx} = (3x^2 - 1) \cdot dx$

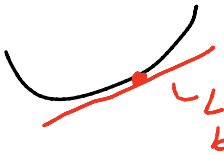
$dy = (3(2)^2 - 1) \cdot (-0.1)$

$dy = 11 \cdot -0.1 = -1.1 =$ change in y

$F''(x) = 6x$

when $x = 2$

$F''(2) = 12 = +$ concave up



Line below underestimate

$F(x) = 2x^3 - 3x^2 - 12x$

$F'(x) = 6x^2 - 6x - 12 = 6(x^2 - x - 2) = 6(x-2)(x+1) = 0$ $\quad x = 2$ or $x = -1$

$F'(-2) = 6(-2-2)(-2+1) = - \cdot - = +$

$F'(0) = 6(0-2)(0+1) = - \cdot + = -$

$F'(3) = 6(3-2)(3+1) = + \cdot + = +$