

$$(5) \quad y = x^2 + 2x$$

$$y' = 2x + 2$$

$$\text{Set } y' = 0 : \quad \begin{aligned} 2x + 2 &= 0 \\ 2x &= -2 \\ x &= -1 \end{aligned}$$

y'	$\ominus$	-1	$\oplus$
y	dec		inc

y is decreasing for $x < -1$
 y is increasing for $x > -1$

⑨

$$y = x^2 + 2x$$

$$y' = 2x + 2$$

$$\text{Set } y' = 0 : \quad \begin{aligned} 2x + 2 &= 0 \\ 2x &= -2 \\ x &= -1 \end{aligned}$$

y'	$\ominus$	-1	$\oplus$
y	Dec		Inc

Relative Minimum at $(-1, -1)$
No Relative Maximum

$$y|_{x=-1}$$

(13)

$$y = x^2 + 2x$$

$$y' = 2x$$

$$y'' = 2$$

Means $y'' = 2$ for all x -values

 y'' $\oplus$ y

cu

y is concave up for all x
No points of inflection.

(17)

$$y = x^2 + 2x$$

a) y-intercept

$$x=0 \Rightarrow y=0$$

$$(0,0)$$

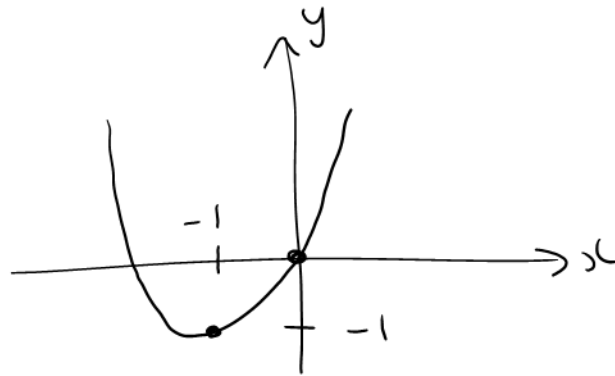
b) Rel Min/Max

From Question 9: Rel Min at $(-1, -1)$

No Rel Max

c) Points of Inflection

From Question 13: No Points of Inflection
 y is concave up for all x



(21)

$$y = 12x - 2x^2$$

a) y-intercept

$$x=0 \Rightarrow y=0$$
$$(0,0)$$

b) Rel Max/Min

$$y' = 12 - 4x$$

Set $y' = 0$:

$$12 - 4x = 0$$
$$12 = 4x$$
$$x = 3$$

y'	$\oplus$	3	$\ominus$
y	Inc		Dec
	Rel Max at $(3, 18)$		
	No Rel Min		
			$y _{x=3}$

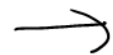
c) Points of Inflection

$$y'' = -4$$

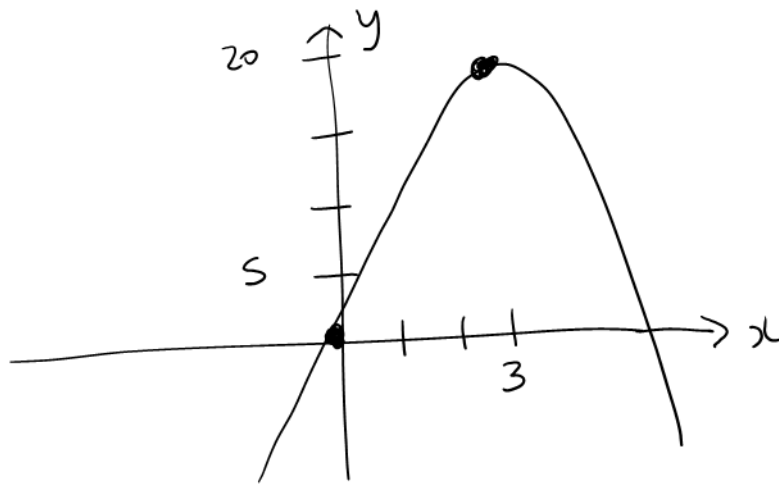
Means $y'' = -4$ for all x

y''		$\ominus$
y		CD

No Points of Inflection
 y is Concave down for all x



(21)
Gut'd



25) $y = x^3 + 3x^2 + 3x + 2$

a) y-intercept

$$x=0 \Rightarrow y=2$$

$$(0, 2)$$

b) Rel Max / Min

$$y' = 3x^2 + 6x + 3$$

Set $y' = 0$:

$$3x^2 + 6x + 3 = 0$$

$$3(x^2 + 2x + 1) = 0$$

$$3(x+1)^2 = 0$$

$$x = -1$$

y'	$\oplus$	-1	$\oplus$
y	inc		inc

y is increasing from $-\infty < x < -1$
and $-1 < x < \infty$

No Rel Max

No Rel Min



(25)
Cont'd

c) Points of Inflection

$$y' = 3x^2 + 6x + 3$$

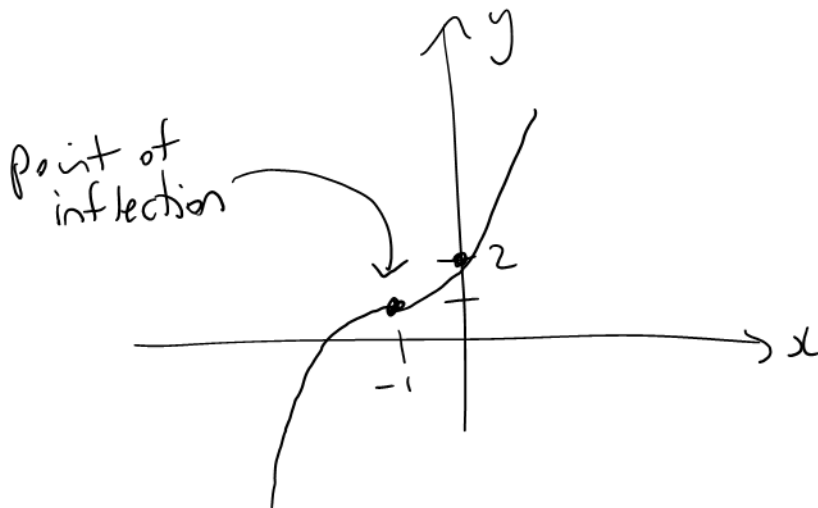
$$y'' = 6x + 6$$

Set $y'' = 0$: $6x + 6 = 0$
 $x = -1$

y''	$\ominus$		-1	$\oplus$
y	CD			CU

Point of Inflection at $(-1, 1)$
 $\nearrow y|_{x=-1}$

d) Sketch



(29)

$$y = 4x^3 - 3x^4 + 6$$

a) y-intercept

$$x=0 \Rightarrow y=6$$
$$(0, 6)$$

b) Rel Max / Min

$$y' = 12x^2 - 12x^3$$

Set $y' = 0$:

$$12x^2 - 12x^3 = 0$$
$$12x^2(1-x) = 0$$
$$x = 0, 1$$

y'	$\oplus$	0	$\oplus$	1	$\ominus$
y	Inc		Inc		Dec

Rel Max at $(1, 7)$

$\nwarrow$
 $y|_{x=1}$

c) Points of Inflection

$$y' = 12x^2 - 12x^3$$

$$y'' = 24x - 36x^2$$

Set $y'' = 0$:

$$12x(2-3x) = 0$$
$$\begin{array}{ccc} \downarrow & & \downarrow \\ x=0 & & 2-3x=0 \\ & & 2=3x \\ & & x=\frac{2}{3} \end{array}$$

$\rightarrow$

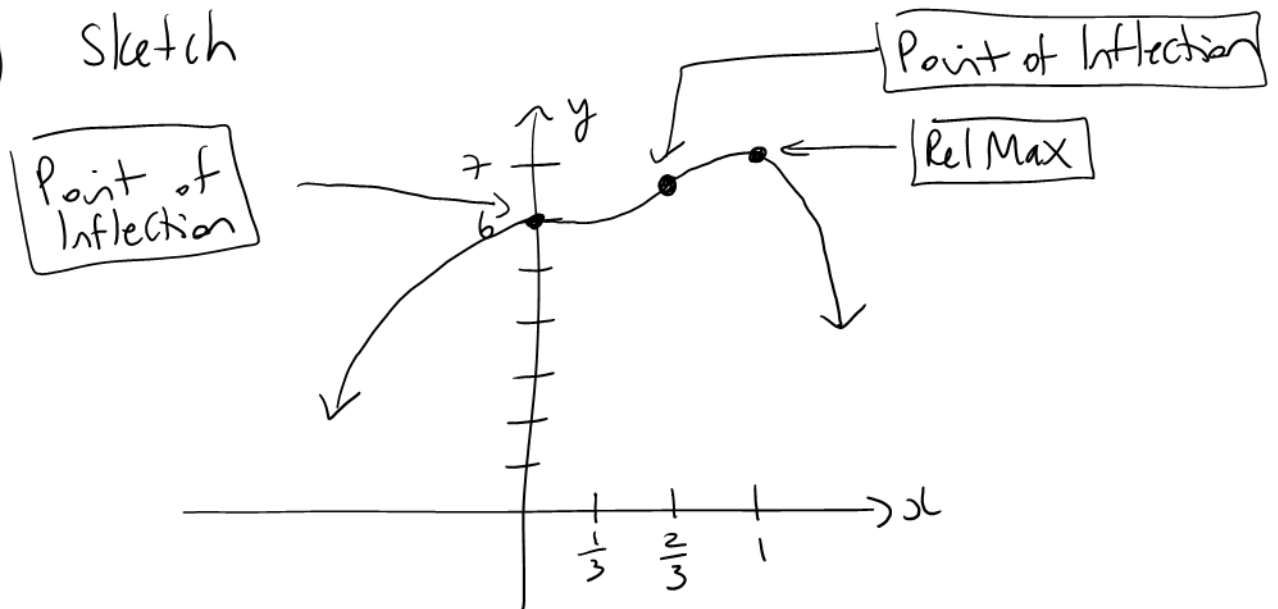
(29)
6th'd

y''	$\ominus$	0	$\oplus$	$\frac{2}{3}$	$\ominus$
y	CD		CU		CD

$$y'' = 24x - 36x^2$$

Points of Inflection at $(0, 6)$ $\swarrow y|_{x=0}$
and $(\frac{2}{3}, 6.6)$ $\swarrow y|_{x=\frac{2}{3}}$

d) Sketch



(39)

$$y = x - 0.025x^2$$

Path of a Baseball

a) y-intercept

$$x=0 \Rightarrow y=0$$

$$(0,0)$$

b) Rel Max/Min

$$y' = 1 - 0.05x$$

Set $y' = 0$: $1 - 0.05x = 0$

$$1 = 0.05x$$

$$\frac{1}{0.05} = x$$

$$x = 20$$

y'	$\oplus$	20	$\ominus$
y	Inc		Dec

Rel Max at $(20, 10)$

$\nwarrow$
 $y|_{x=20}$

c) Points of Inflection

$$y' = 1 - 0.05x$$

$$y'' = -0.05$$

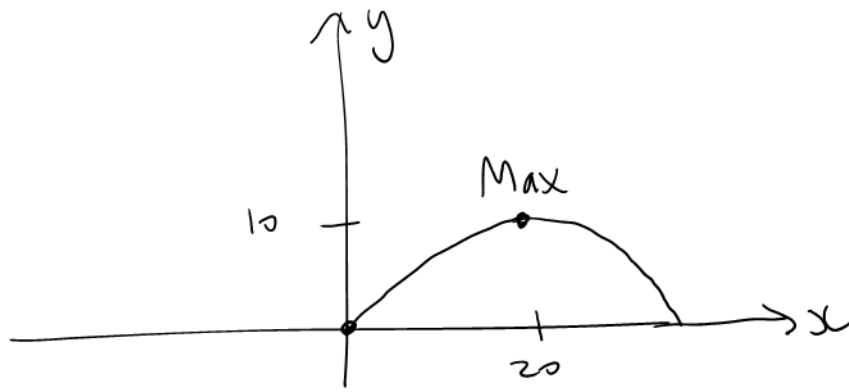
Means $y'' = -0.05$ for all x

y''	$\ominus$
y	CD

No Points of Inflection

y is Concave Down for all $x \rightarrow$

(39)
Cont'd



Path of a Baseball

(47)

 $h = -t^3 + 54t^2 + 480t + 20$ Altitude of a rocketNote: $t \geq 0$ Can rewrite as $y = -x^3 + 54x^2 + 480x + 20$ Note: $x \geq 0$

a) y-intercept

$$x=0 \Rightarrow y=20$$

$$(0, 20)$$

b) Rel Max/Min

$$y' = -3x^2 + 108x + 480$$

Set $y' = 0$:

$$-3x^2 + 108x + 480 = 0$$

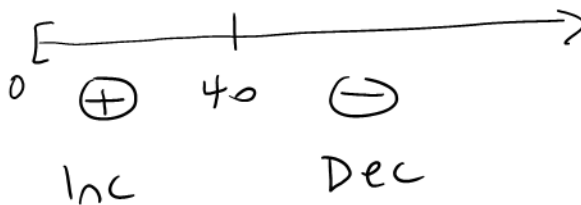
$$-3(x^2 - 36x - 160) = 0$$

$$-3(x - 40)(x + 4) = 0$$

$$x = -4, 40$$

But $x \geq 0$

$$x = 40$$

 y' y 

Rel Max at $(40, 41620)$

$\uparrow$
 $y|_{x=40}$

c) Points of Inflection

$$y' = -3x^2 + 108x + 480$$

$$y'' = -6x + 108$$

Set $y'' = 0$:

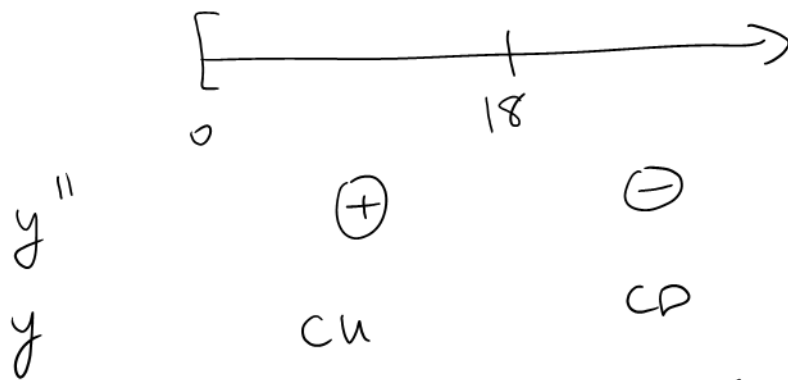
$$-6x + 108 = 0$$

$$108 = 6x$$

$$x = 18$$

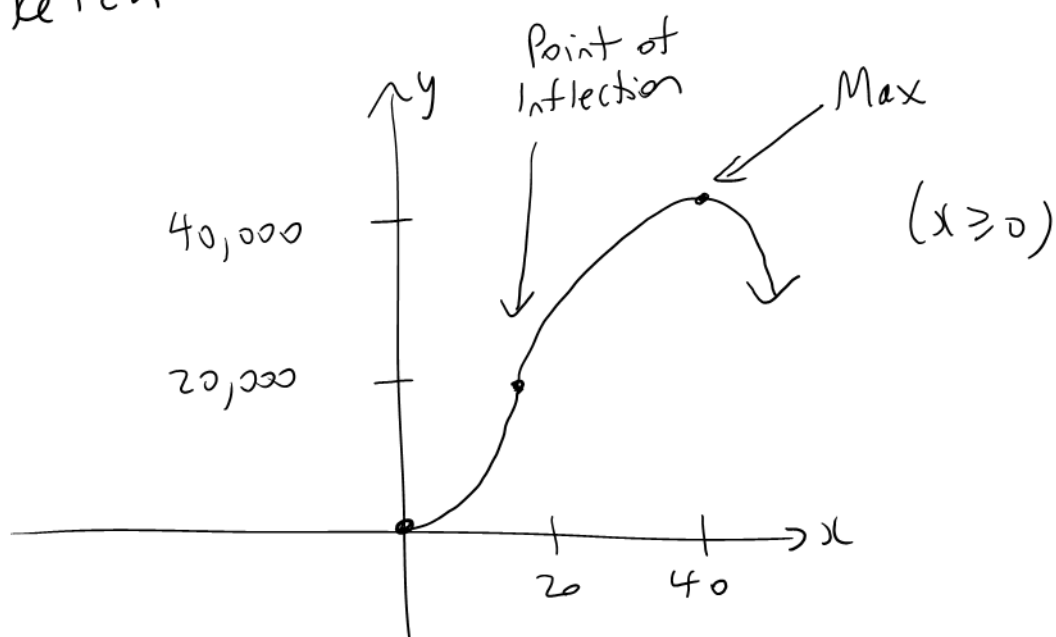
→

(47)
Cont'd



Point of Inflection at $(18, 20324)$
 $y|_{x=18}$

d) Sketch



OR

