ODD ONLY

Calculus Name_____ ID: 1

Concavity Date_____ Period____

find inflection point(s) & then

For each problem, find the open intervals where the function is concave up and concave down.

1) $y = 2x^2 - 5$

$y' = 4x$

$y'' = 4 = 0/DNE$

$x =$ none

y'' ⟷ (+)

inflection pt: none
con. up: $(-\infty, \infty)$
con. down: none

2) ~~$y = -\sec(2x); [-\pi, \pi]$~~

3) $y = -2x^2 - 16x - 33$

$y' = -4x - 16$

$y'' = -4 = 0/DNE$

$x =$ none

y'' ⟷ (−)

infl. pt: none
con. up: none
con. down: $(-\infty, \infty)$

4) ~~$y = -\dfrac{x^2}{2x+2}$~~

~~$y' = \dfrac{(2x+2)(-2x) - (-x^2)(2)}{(2x+2)^2}$~~

~~$y'' = \dfrac{}{}$~~

5) $y = \dfrac{2x}{x+1}$

$y' = \dfrac{(x+1)(2) - (2x)(1)}{(x+1)^2}$

$y' = \dfrac{2x+2-2x}{(x+1)^2} = \dfrac{2}{(x+1)^2}$

$y'' = \dfrac{(x+1)^2(0) - (2)(2(x+1))}{(x+1)^4} = \dfrac{-4x-4}{(x+1)^4} = 0/DNE$

$x = -1$ ← POSSIBLE IP

y'' ⟷ (+) | (−), split at -1

-1 ↑ now verified IP

infl. pt: $x = -1$
con. up: $(-\infty, -1)$
con. down: $(-1, \infty)$

6) ~~$y = -2x^2 - 12x - 19$~~

7) $y = \dfrac{x}{x^2-1}$

$y' = \dfrac{(x^2-1)(1) - (x)(2x)}{(x^2-1)^2}$

$= \dfrac{x^2-1-2x^2}{(x^2-1)^2} = \dfrac{-x^2-1}{(x^2-1)^2}$

$y'' = \dfrac{(x^2-1)^2(-2x) - (-x^2-1)(2(x^2-1)\cdot 2x)}{(x^2-1)^4} = 0/DNE$

$= \dfrac{2x(-x^4+x^3-x^2-2x+1)}{(x^2-1)^4} = 0/DNE$

$x = 0, \pm 1$ ← POSSIBLE IPs

y'' ⟷ (−) | (+) | (−) | (+), split at $-1, 0, 1$

now verified IPs

infl. pt: $x = 0, \pm 1$
con. up: $(-1, 0) \cup (1, \infty)$
con. down: $(-\infty, -1) \cup (0, 1)$

EVEN ONLY

(8) $y = -(x-4)^{\frac{1}{3}}$

$y' = -\frac{1}{3}(x-4)^{-2/3}$

$y'' = \frac{2}{9}(x-4)^{-5/3} \cdot 1 = 0/DNE$

$= \frac{2}{9} \cdot \frac{1}{(x-4)^{5/3}} = 0/DNE$

9) $y = -\frac{x}{x^2-4}$. $x = 4$ ← POSSIBLE IP

now verified IP

inflec. pt: $x = 4$
concave down: $(-\infty, 4)$
concave up: $(4, \infty)$

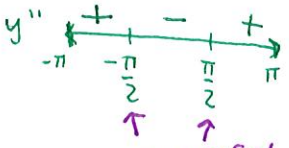
(10) $y = 2\cos(x)$; $[-\pi, \pi]$

$y' = -2\sin x$

$y'' = -2\cos x = 0/DNE$

$\cos x = 0/DNE$

$x = \pm \pi/2$ ← Possible IPs



now verified IPs

inflect. pt: $x = \pm \pi/2$
concave up: $(-\pi, -\frac{\pi}{2}) \cup (\frac{\pi}{2}, \pi)$
concave down: $(-\frac{\pi}{2}, \frac{\pi}{2})$

~~11) $y = -x^3 + 2x^2 + 2$~~

(12) $y = \csc(x)$; $[-\pi, \pi]$

$y' = -\cot x \csc x$

$y'' = (\csc x)(\csc^2 x) + (-\cot x)(-\cot x \csc x) = 0/DNE$

$\csc^3 x + \csc x \cot^2 x = 0/DNE$

$\csc x (\csc^2 x + \cot^2 x) = 0/DNE$

~~13) $y = (4x-24)^{\frac{1}{2}}$~~

$\csc x = 0/DNE$

$\frac{1}{\sin x} = 0/DNE$

$x = \pm\pi, 0$

$\csc^2 x + \cot^2 x = 0/DNE$

$1 + \cot^2 x = 0$

$\cot^2 x = -1$

$\cot x = \sqrt{-1}$

$x = $ none

inflec. pt: $x = 0$
con. up: $(0, \pi)$
con. down: $(-\pi, 0)$

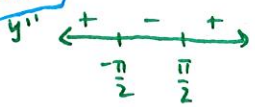
(14) $y = \cos(x)$; $[-\pi, \pi]$

$y' = -\sin x$

$y'' = -\cos x = 0/DNE$

$\cos x = 0$

$x = \pm \pi/2$ ← Possible IP



now verified IPs

inflect. pt: $x = \pm \pi/2$
concave up: $(-\pi, -\frac{\pi}{2}) \cup (\frac{\pi}{2}, \pi)$
concave down: $(-\frac{\pi}{2}, \frac{\pi}{2})$

* y' is same as #10 *

