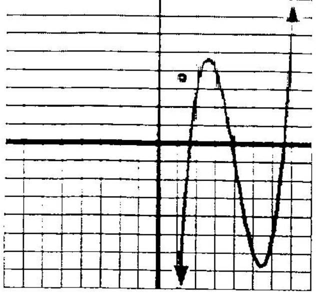
Identify the DOMAIN & RANGE of each of the following functions (use interval notation):

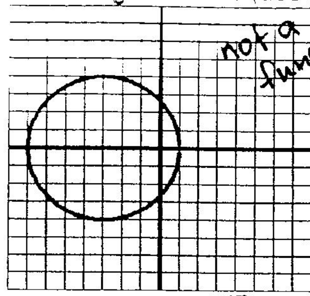
d)



Domain: $(-\infty,\infty)$

Range: $(-\infty,\infty)$

e)

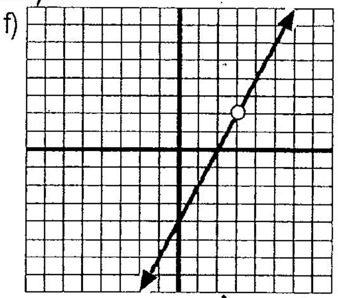


not a function

Domain: $[-7,1]$

Range: $[-4,4]$

f)

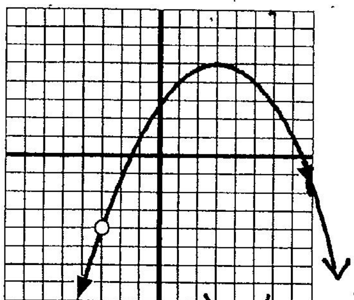


Domain: $(-\infty,3)\cup(3,\infty)$

Range: $(-\infty,2)\cup(2,\infty)$

NOW YOU TRY

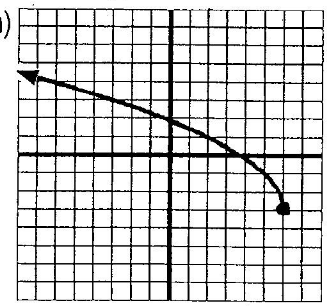
g)



Domain: $(-\infty,-3)\cup(-3,\infty)$

Range: $(-\infty,5]$

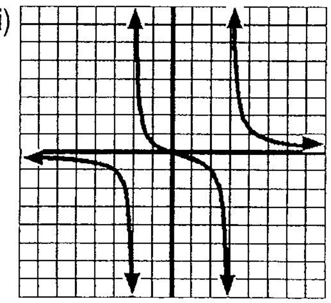
h)



Domain: $(-\infty,6]$

Range: $[-3,\infty)$

i)



Domain: $(-\infty,-2)\cup(-2,3)\cup(3,\infty)$

Range: $(-\infty,\infty)$

Identifying the DOMAIN given only the equation of a function

Rules for Domain (x-values):

- Can't take $\sqrt{\ }$ of a negative #
- Can't $\div$ by 0

Sample: $f(x) = |x-5|+2$ Domain: $(-\infty,\infty)$ Range: $[2,\infty)$

Examples: Find the domain.

1. $f(x)=\sqrt{x+4}$ $x+4\geq 0$
   $x\geq -4$
   $[-4,\infty)$

2. $g(x)=\frac{2}{x-5}$ $x-5\neq 0$
   $x\neq 5$
   $(-\infty,5)\cup(5,\infty)$

Helpful hint→ Ask yourself… "What numbers are acceptable to substitute in the function for x?"

For the following functions, determine the domain algebraically using the rules and then look at the graph to confirm. Are there errors in the y-column in the table? (ONLY use interval notation):

a) $f(x)=\sqrt{x+3}$ $x+3\geq 0$
$x\geq -3$

Domain: $[-3,\infty)$

b) $g(x)=\dfrac{3}{5x-4}$ $5x-4\neq 0$
$x\neq \frac{4}{5}$

Domain: $(-\infty,4/5)\cup(4/5,\infty)$

c) $h(x)=\dfrac{\sqrt{x}}{x-5}$ $x\geq 0$
$x-5\neq 0$
$x\neq 5$

Domain: $[0,5)\cup(5,\infty)$

$\ldots) = \frac{\sqrt{x}}{x^2 - 5x}$ → $x \geq 0$
$x^2 - 5x \neq 0$
$x(x-5) \neq 0$
$x \neq 0$ $x-5 \neq 0$
$x \neq 5$

Domain: $(0,5) \cup (5,\infty)$

e) $g(x) = \frac{x+5}{x^2 - x - 20}$
$x^2 - x - 20 \neq 0$
$(x-5)(x+4) \neq 0$
$x-5 \neq 0$ $x+4 \neq 0$
$x \neq 5$, $x \neq -4$

Domain: $(-\infty,-4) \cup (-4,5) \cup (5,\infty)$

$h(x) = \frac{3}{x^2+1}$
$x^2 + 1 \neq 0$
$x^2 \neq -1$
$x \neq \pm\sqrt{-1}$
imaginary

Domain: $(-\infty,\infty)$

NOW YOU TRY

g) $f(x) = \frac{\sqrt{x-2}}{x+1}$
$x - 2 \geq 0$
$x \geq 2$
$x + 1 \neq 0$
$x \neq -1$

Domain: $[2,\infty)$

h) $g(x) = \frac{x^2}{3x^2 - x - 2}$

Domain: ____________

i) $h(x) = 3(x-4)^2 - 7$

Domain: ____________

Identifying the RANGE given only the equation of a function

Find the range by looking at the possible y values on the graph (use interval notation).

a) $f(x) = |x+5|$ Range:

b) $g(x) = \frac{1}{x^2-4}$ Range:

c) $h(x) = \frac{1}{x} + 1$ Range:

d) $k(x) = 2x^3 + 5$ Rangle:

More practice → For these last functions, find both the domain and range.

1) $y = \sqrt{16 - x^2}$

Domain:

Range:

2) $f(x) = \frac{2}{3x^2+7x-20}$

Domain:

Range:

3) $y = -(x-1)^2 - 4$

Domain:

Range:

Pre-Calculus

Name: ____________________

Notes 1.2 (Part 2)

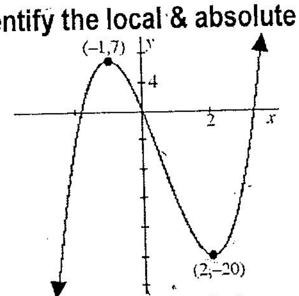
Goal #1: Students will be able to identify local and absolute extrema.
Goal #2: Students will be able to use interval notation to state increasing, decreasing, and constant intervals.
Goal #3: Students will be able to determine the symmetry of a function and classify it as "even," "odd," or "neither."
Goal #4: Students will be able to determine the boundedness of a function.

Local & Absolute Extrema

Local (relative) Maximum:
Local (relative) Minimum: graph turns or has endpoints
Absolute (global) Maximum: the highest y-value
Absolute (global) Minimum: the lowest y-value

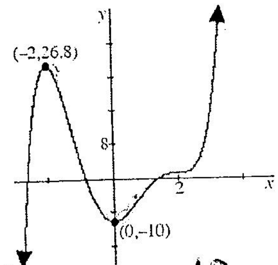
Identify the local & absolute maximums & minimums for each of the functions below:

a)



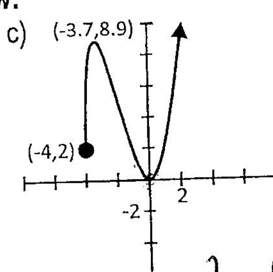
Local minimum: −20
Local maximum: 7
Absolute minimum: none
Absolute maximum: none

b)



Local minimum: −10
Local maximum: 26.8
Absolute minimum: none
Absolute maximum: none

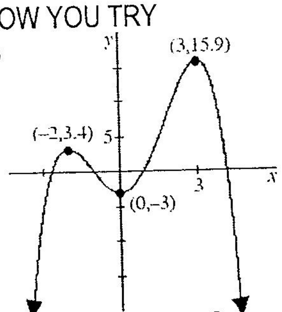
c)



Local minimum: 2, 0
Local maximum: 8.9
Absolute minimum: 0
Absolute maximum: none

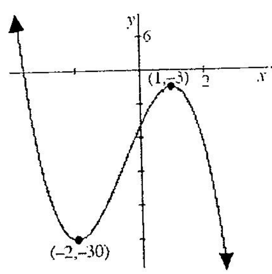
NOW YOU TRY

d)



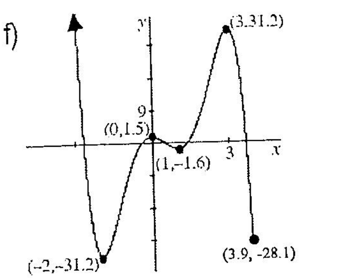
Local minimum: −3
Local maximum: 3.4, 15.9
Absolute minimum: none
Absolute maximum: 15.9

e)



Local minimum: −30
Local maximum: −3
Absolute minimum: none
Absolute maximum: none

f)



Local minimum: ________
Local maximum: ________
Absolute minimum: ________
Absolute maximum: ________

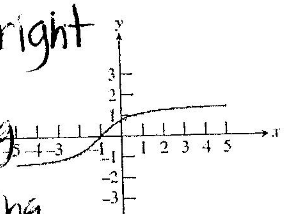
Increasing & Decreasing Interval

left to right

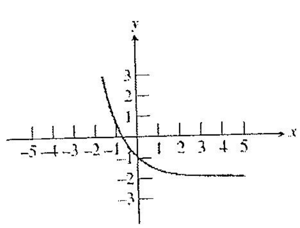
↑ increasing

↘ decreasing

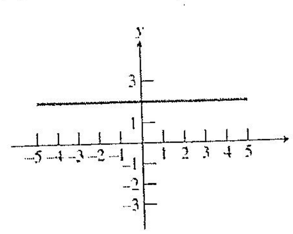
→ constant



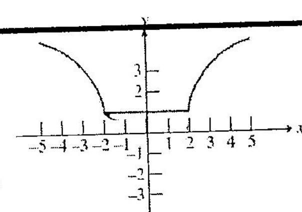
Increasing



Decreasing



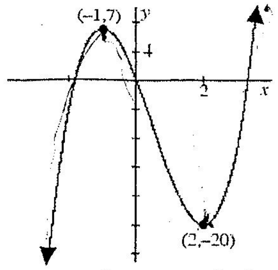
Constant



Decreasing on $(-\infty, -2)$
Constant on $(-2, 2)$
Increasing on $(2, \infty)$

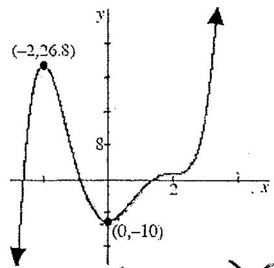
urself the question- "For which x-values are the y-values increasing or decreasing?"
y the interval(s) over which the following functions are increasing & decreasing:

a)



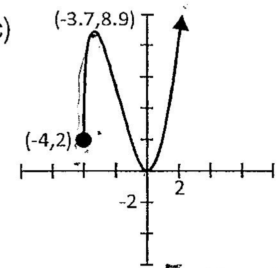
Increasing: $(-\infty,-1)(2,\infty)$
Decreasing: $(-1,2)$

b)



Increasing: $(-\infty,-2)(0,\infty)$
Decreasing: $(-2,0)$

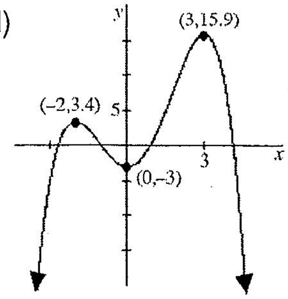
c)



Increasing: $[-4,-3.7)\ (0,\infty)$
Decreasing: $(-3.7,0)$

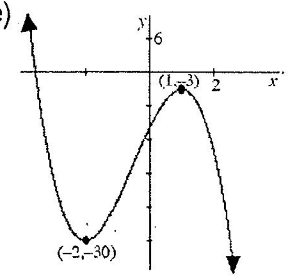
NOW YOU TRY

d)



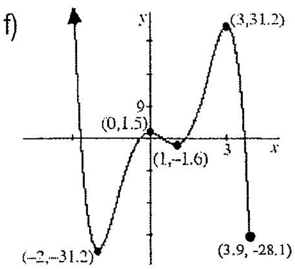
Increasing: $(-\infty,-2)\ (0,3)$
Decreasing: $(-2,0)\ (3,\infty)$

e)



Increasing: $(-2,1)$
Decreasing: $(-\infty,-2)(1,\infty)$

f)



Increasing: ________
Decreasing: ________

Put it all together → Identify the following given only the function. (You may use your calculator)

1) $f(x) = 6x^3 - 12x + 5$

Local Max: ________ Local Min: ________
Increasing: ________ Decreasing: ________

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

Local Max: ________ Local Min: ________
Increasing: ________ Decreasing: ________

3) $y = \sqrt{3x - 12}$

Local Max: ________ Local Min: ________
Increasing: ________ Decreasing: ________

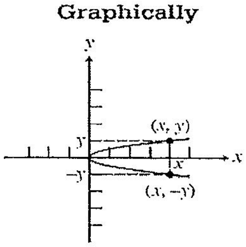
4) $f(x) = -5x + 4$

Local Max: ________ Local Min: ________
Increasing: ________ Decreasing: ________

Symmetry

Symmetry with respect to the x-axis. "NEITHER"

Graphically

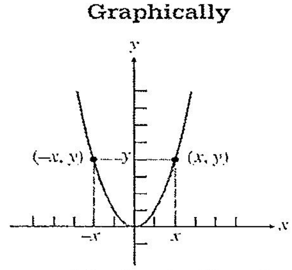


Algebraically

Graphs with this kind of symmetry are not functions (except the zero function), but we can say that $(x, -y)$ is on the graph whenever (x, y) is on the graph.

Symmetry with respect to the y-axis. "EVEN"

Graphically



Algebraically same

For all x in the domain of f,

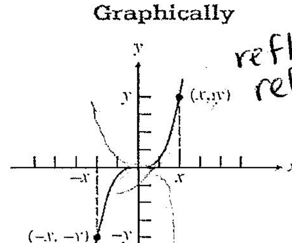
$$f(-x) = f(x)$$

Functions with this property (for example, x^n, n even) are **even** functions.

Symmetry with respect to the origin. "ODD"

Graphically

reflect over y
reflect over x



Algebraically opposite

For all x in the domain of f,

$$f(-x) = -f(x).$$

Functions with this property (for example, x^n, n odd) are **odd** functions.

replace "x" with "−x"

Determine algebraically if each of the following functions is even, odd, or neither.

a) $f(x) = x^2 - 3$

$f(-x) = (-x)^2 - 3$

$= x^2 - 3$ same

even

b) $g(x) = x^2 - 2x - 2$

$g(-x) = (-x)^2 - 2(-x) - 2$

$= x^2 + 2x - 2$

neither

c) $h(x) = \dfrac{x^3}{4 - x^2}$

$h(-x) = \dfrac{(-x)^3}{4 - (-x)^2} = \dfrac{-x^3}{4 - x^2}$

opposite odd

NOW YOU TRY

d) $f(x) = -2x^4 \sqrt{x+3}$

$f(-x) = -2(-x)^4 \sqrt{-x+3}$

$= -2x^4 \sqrt{-x+3}$

neither

e) $g(x) = 7x^5 - 4x^3 + 11x$

$g(-x) = 7(-x)^5 - 4(-x)^3 + 11(-x)$

$= -7x^5 + 4x^3 - 11x$

opposite

odd

f) $h(x) = \dfrac{x^3}{4x - x^5}$

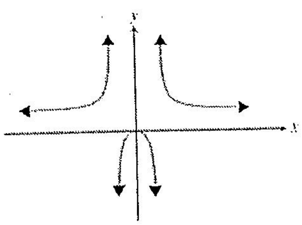
$h(-x) = \dfrac{(-x)^3}{4(-x) - (-x)^5} = \dfrac{-x^3}{-4x + x^5}$

$\dfrac{-x^3}{-(4x - x^5)}$

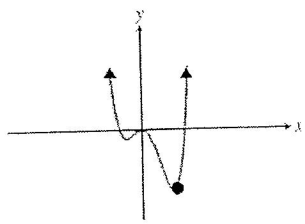
$= \dfrac{x^3}{4x - x^5}$, same even

Boundedness

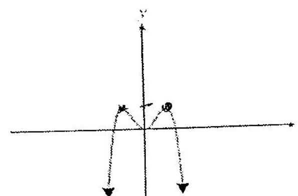
- A function f is "***BOUNDED BELOW***" if f has an abs. min.
- A function f is "***BOUNDED ABOVE***" if f has an abs. max
- A function f is "***BOUNDED***" if f is bounded both above and below
- A function f is "***UNBOUNDED***" if f is not bounded below or above.



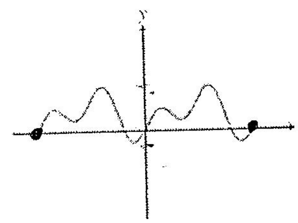
Not bounded above
Not bounded below



Not bounded above
Bounded below



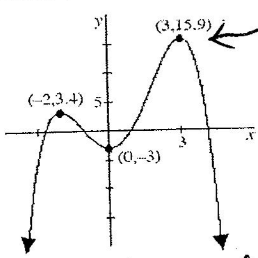
Bounded above
Not bounded below



Bounded

Determine the boundedness of the functions below:

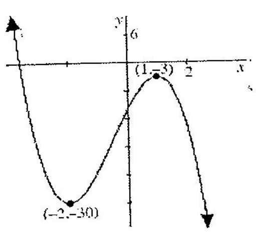
a)



abs. max

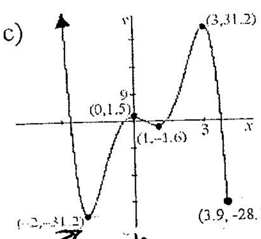
Boundedness: bounded above

b)



Boundedness: unbounded

c)

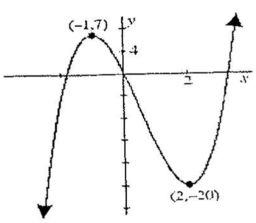


abs. min

Boundedness: bounded below

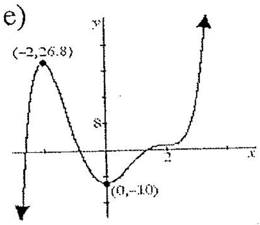
NOW YOU TRY

d)



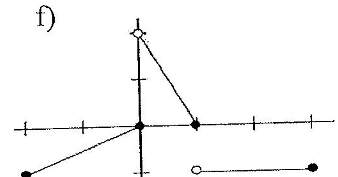
Boundedness: unbounded

e)



Boundedness: unbounded

f)



Boundedness: bounded