College Algebra M121 Goody

Name Key

Climb the Ladder 3.4 3.5

Period____

State the possible number of positive and negative zeros for each function.

Goody's hand Game and DeCartes Rule Sign

1) $f(x) = 3x^5 - 9x^4 + x^3 - 3x^2 - 24x + 72$

+ ① − ② + ③ − − ④ +

4 positive Sign changes 4,2,0 positive

negative 1 Sign Change

− − − − ① + +

A) Possible # positive real zeros: 4, 2, or 0
Possible # negative real zeros: 1

B) Possible # positive real zeros: 4, 2, or 0
Possible # negative real zeros: 0

C) Possible # positive real zeros: 4, 2, or 0
Possible # negative real zeros: 3

D) Possible # positive real zeros: 5, 3, or 1
Possible # negative real zeros: 1

5, 3, 1 Real

2) $f(x) = 2x^6 + x^4 - 50x^2 - 25$

+ + ① −

A) Possible # positive real zeros: 0
Possible # negative real zeros: 1

B) Possible # positive real zeros: 1
Possible # negative real zeros: 2

C) Possible # positive real zeros: 1
Possible # negative real zeros: 1

D) Possible # positive real zeros: 2 or 0
Possible # negative real zeros: 0

Sign changes positive
1 Sign Change
Negative
+ + − −
①
1 negative Change

State the number of complex roots, the possible number of real and imaginary roots, and the possible rational roots for each equation. Use Goody's hand game. YOU DO NOT HAVE TO SOLVE

Pool Poss

$\frac{p}{q}$ $\frac{\pm1 \pm2 \pm4 \pm5 \pm10 \pm20}{\pm1}$

3) $x^3 - 5x^2 + 4x - 20 = 0$

3 R 0 Imag
1 R 2 Imag

±1 ±2 ±4 ±5 ±10 ±20

4) $x^5 + 3x^4 - 2x^3 - 6x^2 - 3x - 9 = 0$

5 R 0 Imag
3 R 2 imag
1 R 4 imag

$\frac{p}{q}$ $\frac{\pm1 \pm3 \pm9}{\pm1}$

±1 ±3 ±9

State all the possible rational zeros for each function. Find the pool of possiblilities then find all roots. YOU MUST FIND ALL ROOTS even if they are imaginary

5) $x^3 - 2x^2 - 2x + 4 = 0$

3 R roots

±1 ±2 ±4

±2 ±1 ±4

X = 2

(X − 2) factor

now Synthetic divide to find other factor

2	1	−2	−2	4
	↓	2	0	−4
	1	0	−2	0

(X − 2)(X² − 2) = 0 Now Solve

X = 2 $X^2 - 2 = 0$ (+2 +2) $X = \pm\sqrt{2}$

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

±1 ±3 Use Calc to find root

root is X = 3

(X − 3) factor

3	1	−3	1	−3
	↓	3	0	3
	1	0	1	0

(X − 3)(X² + 1) = 0 now solve

X = 3 $X^2 + 1 = 0$ (−1 −1)

$X^2 = -1$

$X = \pm i$

1 R 2 imag

h k Method

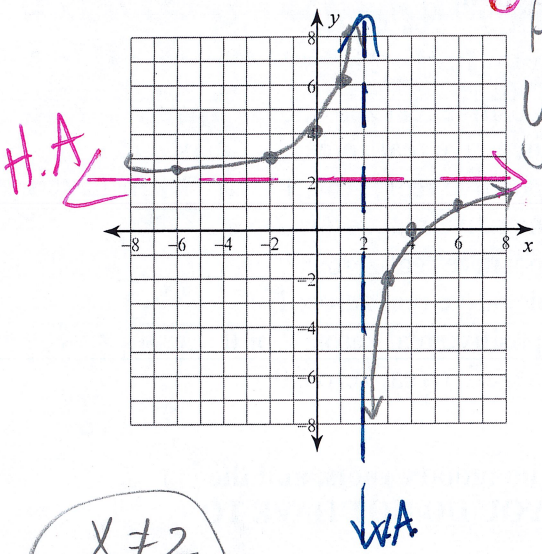
Graph each function. Draw all Asymptotes state any points of discontinuity

7) $f(x) = -\dfrac{4}{x-2} + 2$

$X = 2$ V. A

$y = 2$ H. A

Parent $y = \dfrac{-4}{x}$



x	y
-8	$\frac{1}{2}$
-4	1
-2	2
-1	4
1	-4
2	-2
4	-1
8	$-\frac{1}{2}$

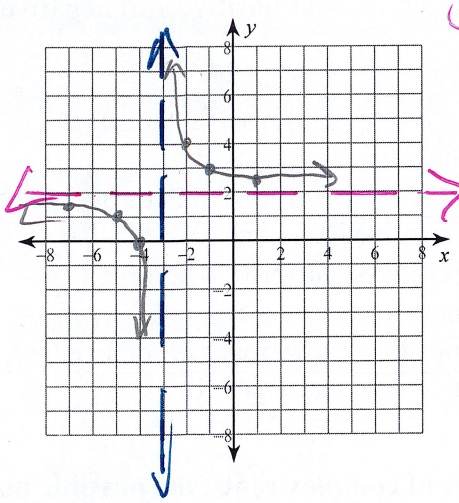
$X \neq 2$

8) $f(x) = \dfrac{2}{x+3} + 2$

$X = -3$ V. A

$y = 2$ H. A

$y = \dfrac{2}{x}$ Parent



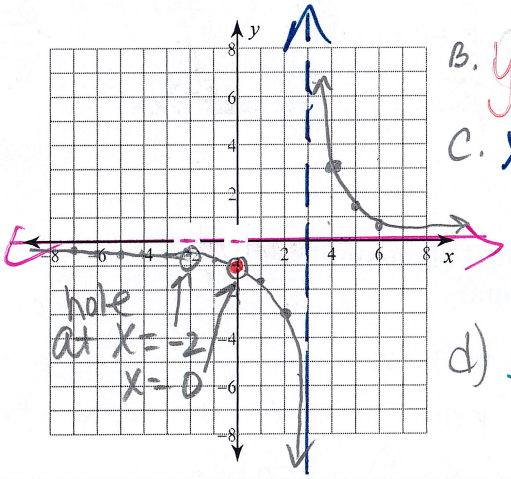
x	y
-4	$-\frac{1}{2}$
-2	-1
-1	-2
1	2
2	1
4	$\frac{1}{2}$

Use your seven steps to graph. State all the points of discontinutity and draw ALL asymptotes. SHOW ALL WORK

9) $f(x) = \dfrac{+3x^2 + 6x}{x^3 - x^2 - 6x}$

← change that to a positive

A. factor first $\dfrac{3x(x+2)}{x(x^2 - x - 6)} = \dfrac{3x(x+2)}{x(x+2)(x-3)}$ (-6: -3, 2, -1)



B. y-intercept (0, -1) Set $x = 0$ Simplify First $\dfrac{3}{x-3}$ $y = \dfrac{3}{0-3}$ $y = -1$

hole none so really no y-intercept

C. X-intercept Set numerator = 0 Simplify → $\dfrac{3}{x-3}$

$0 = 3$ None

d) find Vertical Asymptotes or holes

$\dfrac{3x(x+2)}{x(x+2)(x-3)}$ hole at $X = 0$

$X = -2$

$X = 3$ V. A

$y = \dfrac{3}{x-3}$

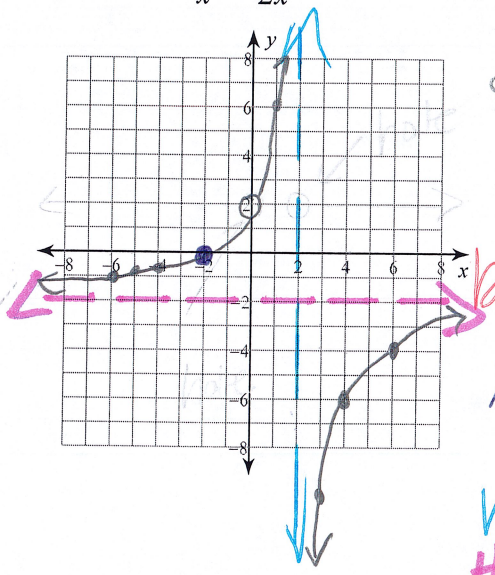
e) Horizontal Asymptotes $n < m$ $y = 0$

f) Use Calc to get points

-7	-.3
-6	-.333
-5	-.375
-4	-.429
-3	-.5
-2	error hole
-1	-.75
0	hole
1	-1.5
2	-3
3	V.A error
4	3

x	y
5	1.5
6	1
7	.75
8	.6

10) $f(x) = \dfrac{-2x^2 - 4x}{x^2 - 2x}$



factor first $\dfrac{-2x(x+2)}{x(x-2)}$

$\frac{x}{x}$ divides out so $x=0$ hole

Simplify hole at $x=0$ $\dfrac{-2(x+2)}{(x-2)}$

y intercept Set $x=0$ $\dfrac{-2(0+2)}{(0-2)}$ $(0,0)$ but hole so y-inter

None because its a hole

X-Intercept Set Numerator $=0$ $-2(x+2)=0$

$x+2=0$

$x=-2$

$(-2,0)$

V.A. $x=2$ hole @ $x=0$

H.A. n=m so $y=\frac{-2}{1}$ $y=-2$

Points from Calc

State the number of complex roots, the possible number of real and imaginary roots, and the possible rational roots for each equation. Then find all roots.

11) $x^3 + 7x^2 + 12x + 10 = 0$ all steps 3 roots

$\frac{P}{q}$ $\pm 1 \pm 2 \pm 5 \pm 10$

Now graph on calculator to find a root

$-5 = x$ root factor, $(x+5)$ now Synthetic divide to find other factor

-5	1	7	12	10
		-5	-10	-10
	1	2	2	0

$(x+5)(x^2+2x+2)=0$

$x=-5$

Complete the Square Now Solve

$x^2+2x+\boxed{1} = -2+\boxed{1}$

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

$x+1 = \pm i$

$x = -1 \pm i$ 2 imag

$x=-5$ 1 real

-3 roots

12) $x^4 + 10x^2 + 21 = 0$ 4 roots Chunk

$m = x^2$

$(x^2)^2 + 10x^2 + 21 = 0$

$m^2 + 10m + 21 = 0$

21 | 7, 3 | 10

Complete the Square if You don't want to factor

$m^2+10m+\boxed{25} = -21+\boxed{25}$

$\sqrt{(m+5)^2} = \sqrt{4}$

$m+5 = \pm 2$

$m+5=2$ $m+5=-2$

$-5 \quad -5$

$m=-3$ $m=-7$

$\sqrt{x^2} = \sqrt{-3}$ $\sqrt{x^2} = \sqrt{-7}$

$x = \pm i\sqrt{3}$ $x = \pm i\sqrt{7}$

4 answers

Could factor also $(m+7)(m+3)$

$m=-7$ $m=-3$