Practice

MAC 1140 Chapter 3 – TEST #2 ~~9.27.18~~ Name *Solutions* pd.____

SHOW WORK ON ALL PROBLEMS and CIRCLE ANSWERS!

1. Find all asymptotes, holes, x-intercepts, y-intercept and the domain of the function below. Then sketch the function **without the aid of a graphing calculator**. $f(x) = \frac{(x-2)(x-1)}{x^2-1} = \frac{(x-2)\cancel{(x-1)}}{(x+1)\cancel{(x-1)}}$ hole at $x-1=0$, $x=1$, $f(1) = -\frac{1}{2}$

VA: $x = -1$

HA: $y = 1$

OA: none

holes: $(1, -\frac{1}{2})$

x-intercept(s): $(2, 0)$

y-intercept: $(0, -2)$

domain: $(-\infty, -1) \cup (-1, 1) \cup (1, \infty)$

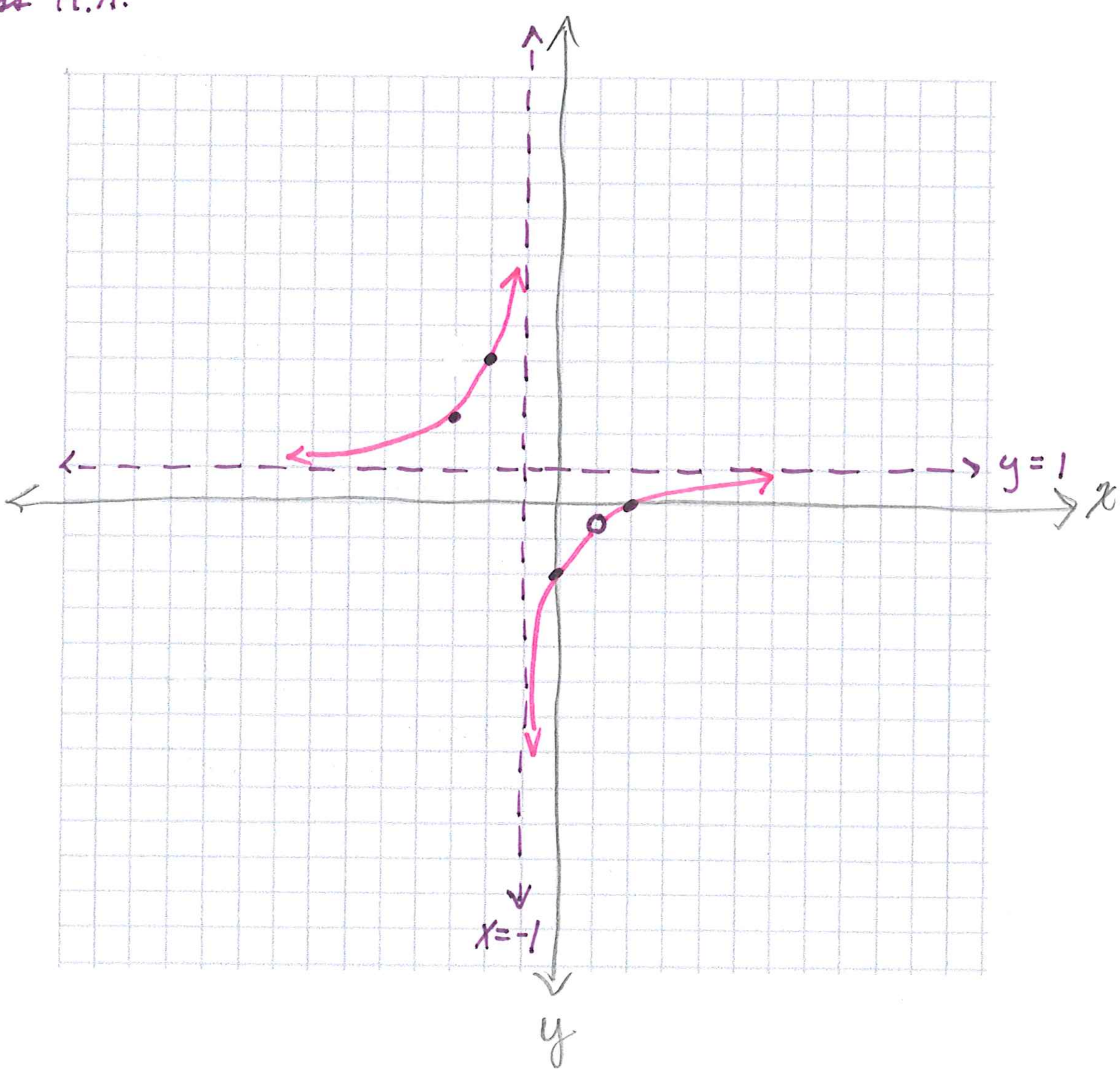
$\frac{x-2}{x+1} = \frac{1}{1}$

$x - 2 = x + 1$

$-2 \neq 1$

$\therefore f(x)$ doesn't cross H.A.

x	y
0	-2
2	0
1	$-\frac{1}{2}$ (hole
-2	4
-3	$\frac{5}{2}$



2. Find the maximum or minimum **value** of the function: $f(x) = x^2 - 8x - 9$. State whether it is a maximum or minimum with the value.

find the vertex: (h, k)

$h = \frac{8}{2(1)} = 4$

$k = f(4) = 4^2 - 8(4) - 9 = -25$

Since this is a parabola that opens up, the vertex is a minimum point.

$\boxed{\text{The minimum value is } -25}$

3. Find the maximum or minimum **value** of the function: $f(x) = -2x^2 + 6x + 3$. State whether it is a maximum or minimum with the value.

$h = \frac{-6}{-2(2)} = \frac{-6}{-4} = \frac{3}{2}$

$k = f(3/2) = -2(3/2)^2 + 6(3/2) + 3 = \frac{15}{2}$

Since this is a parabola that opens down, the vertex is a maximum point.

$\boxed{\text{The maximum value is } 15/2}$

4. Divide using long division. $x^2 + 2x + 3 \div x - 1$. State your answer as a Quotient and Remainder.

$$
\begin{array}{r}
x + 3 \\
x - 1 \overline{) x^2 + 2x + 3} \\
-(x^2 - x) \\
\hline
3x + 3 \\
-(3x - 3) \\
\hline
6
\end{array}
$$

$\boxed{\begin{array}{l} \text{Quotient: } x+3 \\ \text{Remainder: } 6 \end{array}}$

5. Find the value of $f(3)$ by using the **Remainder Theorem** for $f(x) = x^4 - 12x^2 + 2$. Your work must show that you are using the Remainder Theorem.

$$
\begin{array}{r|rrrrr}
3 & 1 & 0 & -12 & 0 & 2 \\
 & & 3 & 9 & -9 & -27 \\
\hline
 & 1 & 3 & -3 & -9 & -25
\end{array}
$$

$\boxed{f(3) = -25}$

6. List all **possible rational zeros** of the function. Simplify and do not list duplicate zeros: $f(x) = 2x^4 - 9x^3 + x^2 - x + 10$.

$\frac{\pm 10}{\pm 2} = \frac{1, 2, 5, 10}{1, 2} = \pm\{1, 1/2, 2, 5, 5/2, 10\}$

with real, rational coefficients

7. Find a polynomial with solutions of $\sqrt{2}$ *and* $-3i$. $x=\sqrt{2}$ $x=-\sqrt{2}$ $x=-3i$ $x=3i$

$(x-\sqrt{2})(x+\sqrt{2})(x-3i)(x+3i)=0$

$(x^2-2)(x^2-9i^2)=0$

$(x^2-2)(x^2+9)=0$

$\boxed{x^4+7x^2-18=0}$

8. Find the maximum height and number of seconds to reach the maximum height, in feet, of a toy rocket t seconds after it is launched if the altitude is given by the function: $s(t)=-16t^2+120t+20$.

Vertex $\left(\frac{-b}{2a}, f\left(\frac{-b}{2a}\right)\right)$

$\frac{-120}{2(-16)}=3.75$

$f(3.75)=-16(3.75)^2+120(3.75)+20$

$f(3.75)=695$

max. height = 695 ft in 3.75 seconds

(a) maximum height: 695

(b) number of seconds to reach maximum height: 3.75

9. Write the function $f(x)=3x^2-12x+1$ in the form of $y=a(x-h)^2+k$

either complete the square or find the vertex.

$a=3$ vertex $=\frac{12}{2\cdot3}=2$

$f(2)=-11$

$\boxed{y=3(x-2)^2-11}$

10. Find all real and imaginary zeros for the function: $f(x) = x^3 - 7x - 6$.

$x^3 + 0x^2 - 7x - 6$

$\frac{\pm 6}{\pm 1} = \pm\{1, 2, 3, 6\}$

$1 \,|\, 1 \quad 0 \quad -7 \quad -6$
$\quad 1 \quad 1 \quad -6$
$1 \quad 1 \quad -6 \quad -12$ X

$-1 \,|\, 1 \quad 0 \quad -7 \quad -6$
$\quad -1 \quad 1 \quad 6$
$1 \quad -1 \quad -6 \quad 0$

$x^2 - x - 6$

$x^2 - x - 6 = 0$
$(x-3)(x+2) = 0$
$x = 3, \; x = -2$

$\boxed{\{-2, -1, 3\}}$

11. Solve the inequality using a number line and the **test point method**. $\frac{2x+1}{x-3} \geq -1$

$\frac{2x+1}{x-3} + 1 \geq 0$

$\frac{2x+1}{x-3} + \frac{x-3}{x-3} \geq 0$

$\frac{3x-2}{x-3} \geq 0$

$3x - 2 = 0$
$3x = 2$
$x = 2/3$ (zero)
$x = 3$ (fcn DNE)

$-\infty \quad 2/3 \quad 3 \quad \infty$

test $x = 0$: $\frac{3(0)-2}{0-3} = \frac{-2}{-3} = \frac{2}{3}$ +

Test $x = 1$: $\frac{3(1)-2}{1-3} = \frac{1}{-2}$ —

test $x = 4$: $\frac{3(4)-2}{4-3} = \frac{10}{1}$ +

$\boxed{(-\infty, 2/3] \cup (3, \infty)}$

12. Find all real and imaginary roots for the function. State the multiplicity of a root when it is greater than one. $f(x) = x^4 - 2x^3 + 5x^2 - 8x + 4$

$\pm\frac{P}{Q} = \frac{1, 2, 4}{1} = \pm\{1, 2, 4\}$

$1 \,|\, 1 \quad -2 \quad 5 \quad -8 \quad 4$
$\quad 1 \quad -1 \quad 4 \quad -4$
$1 \quad -1 \quad 4 \quad -4 \quad 0$

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

$x^2(x-1) + 4(x-1) = 0$

$(x^2+4)(x-1) = 0$

$x^2 = -4 \qquad x = 1$

$x = \pm 2i$

$\boxed{\{1 \text{ w/mult. of } 2, \pm 2i\}}$