Completed

MAT 133 Test 2 Study Guide

Name _____

4.1 Linear Functions

1. Find the following values, and graph the line:

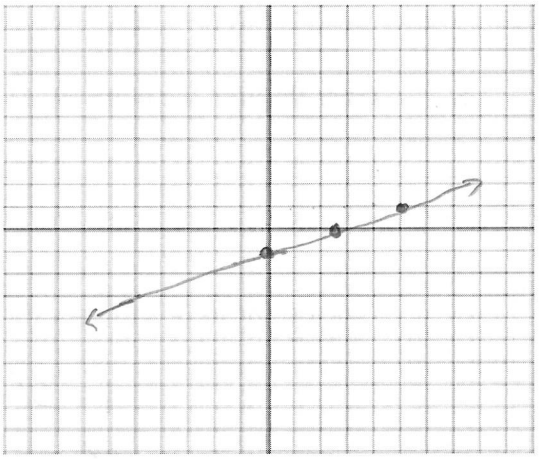
$$5y - 2x = -5 \rightarrow y = \frac{2}{5}x - 1$$

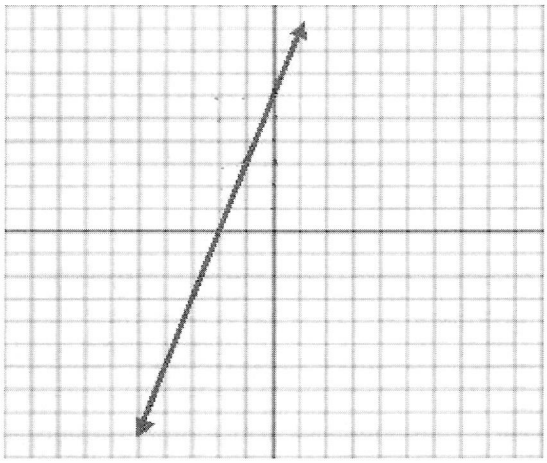
a. X-intercept: $(\frac{5}{2}, 0)$ $5(0) - 2x = -5$, $x = \frac{5}{2}$

b. Y-intercept: $(0, 1)$ $5y - 2(0) = -5$

c. Slope: $\frac{2}{5}$

d.





2. Find the following values, and write the equation of the line.

a. X-intercept: $(-2, 0)$

b. Y-intercept: $(0, 6)$

c. Slope: 3

d. Equation: $y = 3x + 6$

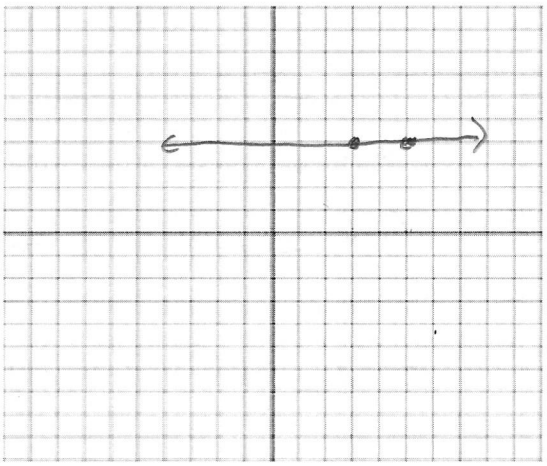
3. For a linear function such that $f(3) = 4$, and $f(5) = 4$, in no particular order, give the **SLOPE, Y-INTERCEPT, EQUATION,** and **GRAPH** of the line.

slope: 0

y-int: (0, 4)

horizontal line

$y = 4$



Write the equation of the line that meets the following criteria: (3 points each)

4. Goes through the points (-1,-7) and (2,8).

$m = \frac{8-(-7)}{2-(-1)} = \frac{15}{3} = 5$ $\quad 8 = 5(2) + b$ $\quad -2 = b$ $\quad y = 5x - 2$

5. Goes through the point (0,-4) and is parallel to $y = 3x - 11$

$y = 3x - 4$

6. Has a slope of 3, and goes through the point (-9,1)

$1 = 3(-9) + b$ $\quad -28 = b$ $\quad y = 3x + 28$

7. Perpendicular to the line $x = 5$, and goes through $(\frac{3}{5}, \frac{6}{17})$.

vertical line

$y = \frac{6}{17}$ ← horizontal line

8. Determine whether the given lines are parallel, perpendicular, or neither.

a. $y = -2x - 5$, $\frac{1}{2}y = x + 3$ $\quad y = 2x + 6$ — neither

b. $3x - y = 4$, $2y = 6x + 1$ $\quad y = 3x - 4$ $\quad y = 3x + \frac{1}{2}$ — parallel

c. $x = \frac{1}{2}$, $3y = 7$ — perpendicular

9. A certain company's yearly profits are steadily increasing. Year 1 they made \$4,300. Comparatively, in year 3 the company profited \$12,700. Come up with a linear model *P(x)* to represent this information, where *P* gives the profits at *x* years of operation, and then make the following predictions.

a. Linear Model: $P(x) = 4200x + 100$

$m = \frac{12{,}700 - 4300}{3-1}$ $\quad \frac{8400}{2} = 4200$ $\quad 4300 = 4200(1) + b$ $\quad 100 = b$

b. If this model is accurate, how much will they profit their 10th year?

$P(10) = 4200(10) + 100 = \$42{,}100$

c. If the trend continues, after how many years of operation will they profit \$100,000 in a year?

(Round up to nearest whole year)

$100{,}000 = 4200x + 100$

$99{,}900 = 4200x$

$x = \frac{99900}{4200} \approx 23.8 \approx 24$ years

5.1 Quadratic Functions

For each of the following quadratic functions, find the *x* and *y* intercepts, the vertex, and at least one other point. Be able to determine end behavior, domain, range, and its axis of symmetry, as well as be able to write it in vertex form, if it is not. Then GRAPH.

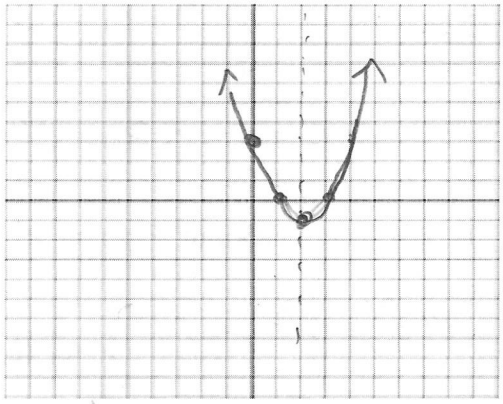
10. $f(x) = x^2 - 4x + 3$ $= (x-3)(x-1)$

$f(0) = 3$ y-int: $(0,3)$

$0 = (x-3)(x-1)$ x-int: $(3,0), (1,0)$

Opening up

vertex: $(2,-1)$



11. $f(x) = -2x^2 - 4x + 4$

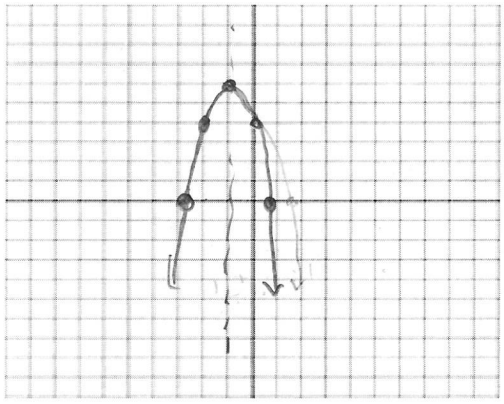
$f(0) = 4$

vertex: $(-1, 6)$

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

$x = \frac{4 \pm \sqrt{16 - 4(-2)(4)}}{2(-2)} = \frac{4 \pm \sqrt{48}}{-4} \approx -2.7$ $\approx .7$

x-int: $\approx (.7, 0), (2.7, 0)$



12. $f(x) = (x-1)^2 + 3$

vertex: $(1,3)$

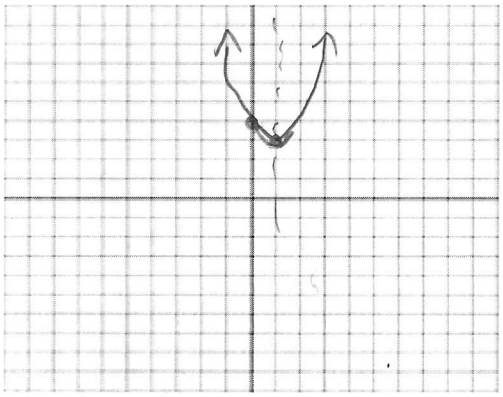
opening up

$f(0) = 4$ y-int: $(0,4)$

No x-ints

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

$(x-1)^2 = -3 \rightarrow x = 1 \pm \sqrt{3}$;



5.2-5.5 Zeros and Graphing of Polynomial Functions

Be able to do polynomial long division and synthetic division. There are plenty of class examples we have worked through that you may refer to, and you can look up additional examples in your book or online.

13. Is $x+6$ is a factor of $P(x) = x^3 + 4x^2 - 27x - 90$? *Use synthetic division to answer.*

$$\begin{array}{r|rrrr} -6 & 1 & 4 & -27 & -90 \\ & & -6 & 12 & 90 \\ \hline & 1 & -2 & -15 & 0 \end{array}$$

yes!

14. Is $x-2$ is a factor of $P(x) = x^3 + 4x^2 - 27x - 90$? *Use the remainder theorem to answer—not division. (P(2)=...)*

$$P(2) = 2^3 + 4(2^2) - 27(2) - 90$$
$$= 8 + 16 - 54 - 90$$
$$= -120$$

no!

Given: $\boldsymbol{g(x) = 3x^4 - x^3 + 19x^2 - 9x + 9}$

15. Including complex and multiplicities, how many *total* zeros does the above $g(x)$ have?

Degree 4 → 4 total zeros

16. List all the possible rational zeros of $g(x)$ according to the Rational Zeros Theorem.

$$\frac{\text{Factors of } 9}{\text{Factors of } 3} \pm \frac{1, 3, 9}{1, 3} = \pm 1, 3, 9, \frac{1}{3}$$

17. According to Descartes' Rule of signs, how many negative real zeros/roots could $g(x)$ have? Does this narrow down the list from the previous question?

$$g(-x) = 3x^4 + x^3 + 19x^2 + 9x + 9$$

zero → yes from 8 to 4

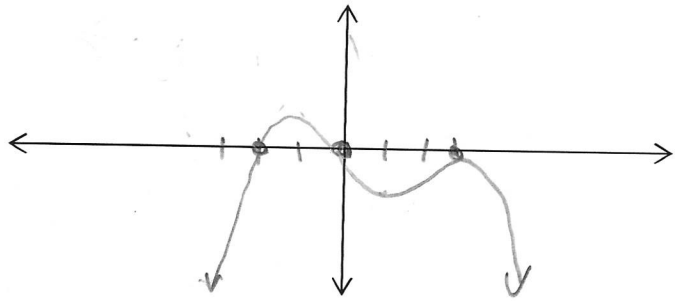
Be able to find all zeros, the y-intercept, determine end behavior, and graph correctly. These 3 are from the notes and/or quiz.

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

leading term: $-x^4$ ↙ ↘

zeros: $x = 0, 3, -2$

y-int: $(0, 0)$



19. $P(x) = 3x^5 + x^4 + x^3 + 7x^2 - 24x + 12$ Hint: -2 is a zero

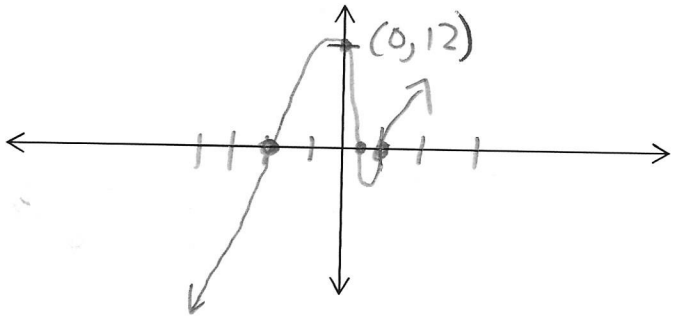
$$\begin{array}{r|cccccc} -2 & 3 & 1 & 1 & 7 & -24 & 12 \\ & & -6 & 10 & -22 & 30 & -12 \\ \hline & 3 & -5 & 11 & -15 & 6 & 0 \end{array}$$

$$\begin{array}{r|ccccc} 1 & 3 & -5 & 11 & -15 & 6 \\ & & 3 & -2 & 9 & -6 \\ \hline & 3 & -2 & 9 & -6 & 0 \end{array}$$

$3x^3 - 2x^2 + 9x - 6$

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

$P(x) = (3x-2)(x^2+3)(x-1)(x+2)$



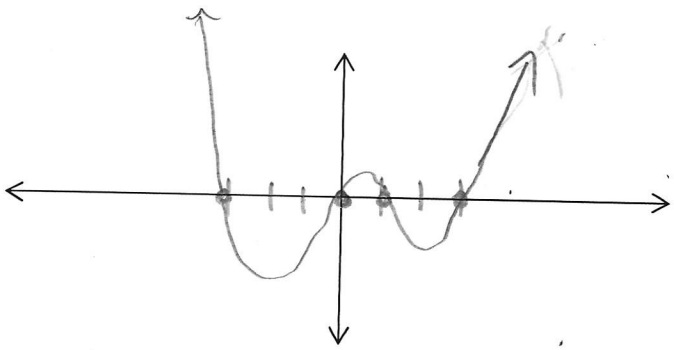
20. $f(x) = 2x^4 - 2x^3 - 18x^2 + 18x$

$2x(x^3 - x^2 - 9x + 9)$

$2x(x^2(x-1) - 9(x-1))$

$2x(x^2-9)(x-1)$

$f(x) = 2x(x+3)(x-3)(x-1)$



5.6 Graphing of Rational Functions

You have worked through several of these in the 5.6 notes and homework, but here is another to try.

$= \frac{(x-5)(x+1)}{(x-2)(x+3)}$

21. Graph $f(x) = \frac{x^2-4x-5}{x^2+x-6}$ and provided the requested information.

Domain = $x \neq 2, -3 \rightarrow (-\infty, -3) \cup (-3, 2) \cup (2, \infty)$

y-intercept = $(0, \frac{5}{6})$

Vertical asymptote(s): $x = 2, x = -3$

x-intercept(s) = $(5, 0)$ $(-1, 0)$

Horizontal asymptote: $y = 1$

Holes: none