Unit 1 Test Review: Sections 1.1–1.5 Name: _____ HR: _____

Skills: Distance & Midpoint (1.1); intercepts, symmetry, circles (1.2); slope & equations of lines (1.3); functions, evaluating, domain, difference quotient (1.4); analyzing graphs (1.5).

Work every problem in the space provided, then check the answers box at the end. Bring questions to class!

1.1 Rectangular Coordinates

1. Find the distance between (−3, 4) and (5, −2), and find the midpoint of the segment joining them.

$MP = \left(\frac{-3+5}{2}, \frac{4+-2}{2}\right) = \left(\frac{2}{2}, \frac{2}{2}\right) = (1,1)$ (x_1, y_1) (x_2, y_2)

$d = \sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$

$= \sqrt{(5--3)^2+(-2-4)^2} = \sqrt{(8)^2+(-6)^2} = \sqrt{64+36} = \sqrt{100} = 10$

Distance: 10 ***Midpoint:*** (1, 1)

1.2 Graphs of Equations

2. Find the x- and y-intercepts of $y = x^2 - x - 6$. Write them as ordered pairs.

x-int (y=0): $x^2-x-6=0$, $(x+2)(x-3)$, $x=-2$ $x=3$

y-int (x=0): $y = 0^2-0-6 = -6$

x-int: (−2, 0) (3, 0) ***y-int:*** (0, −6)

3. Test $y = x^4 - 3x^2$ for symmetry with respect to the x-axis, the y-axis, and the origin.

x-axis: Replace y with −y & get same equation. $-y = x^4-3x^2$, $y = -x^4+3x^2$

$f(x) = x^4-3x^2$, $-f(x) = -x^4+3x^2$

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

y-axis ($f(-x)=f(x)$): $f(-x)=(-x)^4-3(-x)^2 = x^4-3x^2$

Symmetric to: ~~y-Axis~~ (Even)

origin: $f(-x) = -f(x)$; $f(-x) = x^4-3x^2$; $-f(x) = -x^4+3x^2$ Not origin Not ODD

4. (a) Write the standard form of the equation of the circle with center (−1, 4) and radius 3.

$(x-h)^2+(y-k)^2 = r^2$ (h, k) = center

(a) $(x+1)^2+(y-4)^2 = 9$

(b) Find the center and radius of $(x-2)^2+(y+5)^2 = 49$.

$(x-h)^2+(y-k)^2$ $h=2$ $k=-5$ $r^2=49$ $r=7$

(b) center: (2, −5) ***radius:*** 7

1.3 Linear Equations in Two Variables

5. Find the slope of the line through (−1, 5) and (3, −3). Then write its equation in slope-intercept form.

$m = \frac{-3-5}{3-1} = \frac{-8}{4} = -2$

$y-5 = -2(x+1)$

$y-5 = -2x-2$

$y = -2x+3$

m = −2 ***y =*** −2x + 3

6. Write equations of the lines through (2, 1) that are (a) parallel and (b) perpendicular to $3x - y = 4$.

(1) $3x-y=4$, $-3x$ $-3x$, $-y = -3x+4$, $y = 3x-4$, $m=3$

(2a) (2, 1) $m=3$: $y-1=3(x-2)$, $y-1=3x-6$, $+1$ $+1$, $y=3x-5$

(3b) (2, 1) $m=-\frac{1}{3}$: $y-1=-\frac{1}{3}(x-2)$, $y-1=-\frac{1}{3}x+\frac{2}{3}$, $+1$ $+1$, $y=-\frac{1}{3}x+1\frac{2}{3}$, $\frac{5}{3}$

(a) y = 3x − 5 ***(b)*** $y = -\frac{1}{3}x + \frac{5}{3}$

1.4 Functions

7. Is y a function of x? $2x + y^2 = 5$ Explain.

Yes / No —

$\sqrt{y^2} = \sqrt{-2x+5}$

$y = \pm\sqrt{-2x+5}$

when x is input, 2 different y values pair with it ← Not a function

8. Let $f(x) = x^2 - 3x + 2$. Find f(−2) and f(x + 1).

$f(-2) = (-2)^2-3(-2)+2 = 4+6+2 = 12$

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

$1-3+2$, $-2+2$, $= 0$

f(−2) = 12 ***f(x + 1) =*** x^2-x

9. Find the domain: (a) $f(x) = \sqrt{x-6}$ (b) $g(x) = \dfrac{x+1}{x^2-9}$

(a) $f(x) = \sqrt{x-6}$

$x - 6 \geq 0$

$x \geq 6$

(b) $g(x) = \dfrac{x+1}{x^2-9}$

$x^2 - 9 \neq 0$

$(x-3)(x+3) \neq 0$

$x \neq 3, x \neq -3$

(a) $x \geq 6$ *(b)* $\mathbb{R}, x \neq 3, -3$

10. Find and simplify the difference quotient for $f(x) = x^2 + 2x$:

$f(x+h) = (x+h)^2 + 2(x+h)$ $\quad -f(x) = -x^2 - 2x$

$= x^2 + 2xh + h^2 + 2x + 2h$

$\dfrac{f(x+h) - f(x)}{h} = \dfrac{2xh + h^2 + 2h}{h}$

$= 2x + h + 2$

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

1.4 Functions (continued)

11. Evaluate $f(x) = \begin{cases} 2x+1, & x < 0 \\ x^2 - 1, & x \geq 0 \end{cases}$ at f(−3), f(0), and f(2).

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

$= -6 + 1$

$= -5$

$f(0) = 0^2 - 1$

$= -1$

$f(2) = (2)^2 - 1$

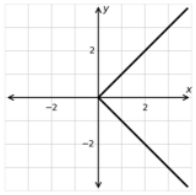
$= 4 - 1$

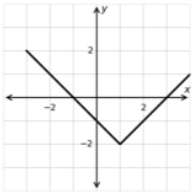
$= 3$

f(−3) = -5 *f(0) =* -1 *f(2) =* 3

1.5 Analyzing Graphs of Functions

12. Use the Vertical Line Test. Does each graph represent y as a function of x?





(a) Yes / No *(b) Yes / No*

13. Find the zeros of $f(x) = x^2 + 2x - 24$ algebraically.

$(x - 4)(x + 6)$

$x = 4 \quad x = -6$

Zeros: $4, -6$

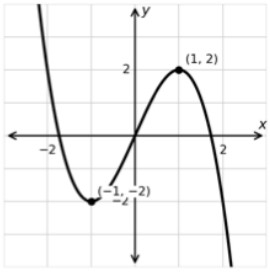
14. Use the graph of $f(x) = -x^3 + 3x$. (Use interval notation)

Increasing: $(-1, 1)$

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

Rel. max: $y = 2$

Rel. min: $y = -2$

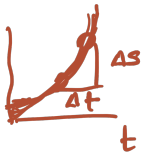


15. A car's distance in feet from a stoplight is $s(t) = 5t^2$, where t is in seconds. Find the car's average speed from t = 0 to t = 6 seconds.

$s(0) = 5(0)^2 = 0$ ft

$s(6) = 5(6)^2 = 5 \cdot 36$

$= 180$ ft



$AROC = \dfrac{\Delta s}{\Delta t}$

$Avg\ of = \dfrac{s(6) - s(0)}{6 - 0}$

$= \dfrac{180 \text{ feet}}{6 \text{ sec}}$

$= 30 \text{ feet/sec}$

Avg. speed = 30 ft/s

16. Find the average rate of change of $f(x) = x^3 - x$ from $x_1 = 0$ to $x_2 = 2$.

$f(0) = 0$

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

$= 8 - 2$

$= 6$

A.R.o.C. = 6

17. Determine algebraically whether each function is even, odd, or neither. Show f(−x).

(a) $f(x) = x^4 + 2x^2$

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

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

$= x^4 + 2x^2$

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

Even / ***Odd*** / ***Neither***

(b) $f(x) = x^3 - 7x$

$f(-x) = (-x)^3 - 7(-x)$

$= -x^3 + 7x$

$-f(x) = -x^3 + 7x$

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

Even / ***Odd*** / ***Neither***

(c) $f(x) = x^2 - 4x$

$f(-x) = (-x)^2 - 4(-x)$

$= x^2 + 4x$

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

$f(-x) \neq f(x)$ $f(-x) \neq -f(x)$

Even / ***Odd*** / ***Neither***

Answers (try first, then check!)

1. d = 10, M = (1, 1) 2. x-int (3, 0), (−2, 0); y-int (0, −6) 3. y-axis only 4. (a) $(x + 1)^2 + (y - 4)^2 = 9$ (b) center (2, −5), r = 7

5. m = −2, y = −2x + 3 6. (a) y = 3x − 5 (b) y = −⅓x + 5⁄3 7. No: x = 2 gives y = 1 and y = −1 8. f(−2) = 12, $f(x + 1) = x^2 - x$

9. (a) [6, ∞) (b) all reals except x = ±3 10. 2x + h + 2 11. −5, −1, 3 12. (a) No (b) Yes 13. x = −6, 4

14. Inc (−1, 1); Dec (−∞, −1) and (1, ∞); rel. max 2 at x = 1; rel. min −2 at x = −1 15. 30 ft/sec 16. 3 17. (a) even (b) odd (c) neither