

MATH 111 CHAPTER 1 (sections 1.1 – 1.5)

- Terms to know: the real (coordinate) line, inequalities, interval notation, solution set, absolute value, rectangular coordinate system, distance, mid-point, circle, radius, center of the circle, completing the square technique, semicircle, symmetry with respect to x-axis, y-axis, origin, rationalization of a denominator and/or numerator.
- Notation to know: open, closed, half-open and infinite intervals. (sec. 1.1)
- Know the properties of inequalities. (sec. 1.1)
- Be able to solve linear, quadratic, absolute-value, and rational inequalities both algebraically and graphically. (sec. 1.1 + 1.2)
- Know and be able to use the definition of the absolute value to simplify algebraic expressions. (sec. 1.2)
- Know properties of absolute-values. (sec. 1.2)
- Be able to solve absolute value equations. (sec. 1.2)
- Know and be able to use the distance and midpoint formulas between two numbers on the number line. (sec. 1.3)
- Know and be able to use the distance and midpoint formulas between two points on xy-plane. (sec. 1.4)
- Be able to sketch the graph of a circle and semicircle. (sec. 1.4)
- Be able to find an equation of the circle from the given information (center, diameter, radius). (sec. 1.4)
- Be able to complete the squares on x- and y-terms to write the standard form of an equation of a circle and find the center and radius of the circle. (sec. 1.4)
- Be able to write an equation of the upper half, lower half, right half, and left half of the circle. (sec. 1.4)
- Be able to find the intercepts and axis of symmetry (y-axis, x-axis, and origin) of the graph. (sec. 1.4)
- Know and be able to use factorization, binomial expansions for $n = 2$ and $n = 3$, and rationalization to simplify algebraic expressions. (sec. 1.5)
- Any handouts given in class, any class discussions.

Partial Review Problems:

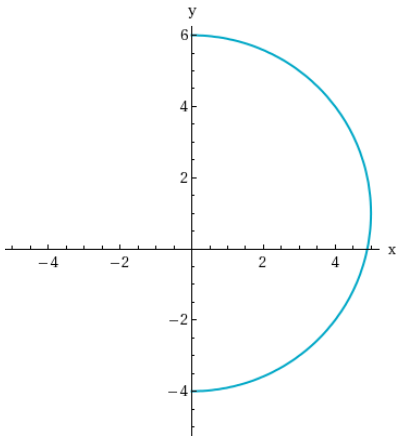
- Write the expression without using absolute value symbols:
 - $|x - 6|$, if $x < 6$; b) $|6 - x|$, if $x = 6$; c) $|a - b| - |b - a|$. (Student Learning Outcome) SLO 6
- Find the center and radius of the circle: $x^2 + y^2 + 2x - 6y + 7 = 0$. SLO 12
- Solve the given inequalities, describe its solution set using the interval notation, and graph the inequalities: a) $-(2x + 1) \geq 3$; b) $x^2 - 4x > -3$; c) $\frac{4x + 5}{x + 2} \geq 3$; d) $|3x - 5| > 2$; e) $|2x + 11| < 5$; f) $x^3 - 4x \geq 0$; g) $\frac{1}{x} < 4$; h) $x < \frac{2}{x - 1}$; i) $2x^2 - 3x - 5 \leq 0$; j) $\frac{x^2 - 2x + 3}{x + 1} \leq 1$; k) $x^2(x - 4)(x - 6)^3 \geq 0$; l) $x^2 - 6x + 9 \geq 0$; m) $5x > 2x^2 - 3$; n) $\frac{4}{x + 2} \leq \frac{2}{x - 1}$; o) $\frac{-10}{x - 5} \geq \frac{-11}{x - 6}$; p) $9|x - 8| - 10 < 26$. SLO 2, 3, 4.
- Find an equation of the circle with the center (1, 3) that passes through (-2, 4). SLO 11
- Let m be the midpoint of the line segment joining a (the left endpoint) and b (the right endpoint). Let $m = 15$, $d(a, m) = 6$. Find a and b . SLO 8
- Find the x- and y-intercepts, and axis of symmetry of the given graph. Also sketch the graph.
 - $f(x) = \frac{x^2 - 1}{x}$
 - $f(x) = -\sqrt{2x} + 3$. SLO 14

7. Sketch the graph of a) $x = \sqrt{25 - (y-1)^2}$; b) $y = \sqrt{49 - x^2}$. SLO 10
8. Write the expression $|x-1| - |x+2|$ without the absolute value symbols if x is in the interval
a) $(-\infty, -2)$; b) $(-2, 1)$. SLO 5
9. Find an equation for the upper half of the circle $x^2 + (y-3)^2 = 4$. SLO 13
10. Find all points on the x-axis that are 3 units from the midpoint of the line segment joining $(3,4)$ and $(-3,-8)$. SLO 9
11. Solve the given equation: a) $\left|\frac{1}{4} - \frac{3}{2}x\right| = 1$; b) $\left|\frac{x+1}{x-2}\right| = 5$. SLO 7
12. Use factorization, binomial expansion or rationalization to simplify the given expression:
a) $\frac{x^3 - 1}{x^2 + 2x - 3}$; b) $\frac{5(x-1)^2 - 8(x-1) - 13}{x}$; c) $\frac{3}{\sqrt{2} - \sqrt{5}}$; d) $\frac{\sqrt{4+x} - 2}{x}$; e) $\frac{x-2}{\sqrt{4x+1} - 3}$; f) $\frac{\sqrt{x^2 + 9} - 5}{x+4}$;
g) $\frac{3x^2 - 8x + 4}{3x^2 + x - 2}$; h) $\frac{2x^2 + 3x - 9}{x^2 - 4x - 21}$. SLO 15
13. Simplify the rational expression:
a) $\frac{x-8}{64-x^2}$; b) $\frac{x^5 + 2x^4 + x^3}{x^4 - 2x^2 + 1}$; c) $\frac{(2x+1)^2 - 9}{x-1}$; d) $\frac{3(h+1)^3 - 8(h+1)^2 + 5}{h}$. SLO 15
14. Add or subtract the rational expressions:
a) $\frac{3}{x-3} + \frac{6}{x^2 + 5x - 24}$; b) $\frac{x}{2x-8} - \frac{6}{x-4}$; c) $\frac{1}{x-2} - \frac{8}{x^2 + 4x - 12}$; d) $\frac{x+2}{x-4} + \frac{x-2}{x+3}$. SLO 15
15. Complete the squares on x- and y-terms of the circle: $4x^2 + 24x + 4y^2 + 36y = 0$. SLO 12
16. Find an equation of the circle with endpoints of a diameter $(-1, 4)$ and $(3, 8)$. SLO 11
17. Find an equation of the circle with center $(2,5)$ and graph is tangent to the x-axis. SLO 11
18. Find the x- and y- intercepts of the given equation: a) $x = 2y^2 - 14$; b) $(x-4)^2 + (y+2)^2 = 16$. SLO 14
19. Find all points on the y-axis that are 6 units from the point $(2, 5)$. SLO 9

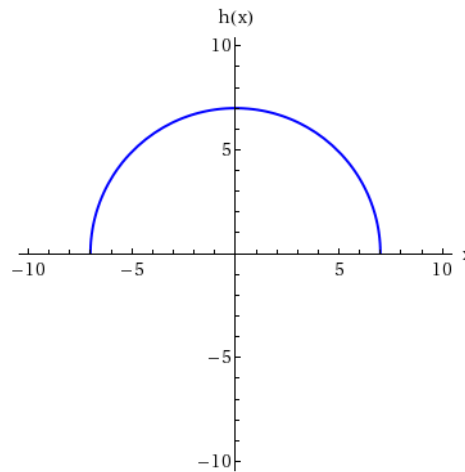
Answers:

1. a) $6 - x$; b) 0; c) 0.
2. center $(-1, 3)$, radius = $\sqrt{3}$
3. (a). $(-\infty, -2]$; (b). $(-\infty, 1) \cup (3, \infty)$; c). $(-\infty, -2) \cup [1, \infty)$; (d). $(-\infty, 1) \cup (\frac{7}{3}, +\infty)$; e). $(-8, -3)$;
f). $[-2, 0] \cup [2, \infty)$; g). $(-\infty, 0) \cup (1/4, \infty)$; h). $(-\infty, -1) \cup (1, 2)$; i) $[-1, 5/2]$; j) $(-\infty, -1) \cup [1, 2]$;
k) $(-\infty, 4] \cup [6, \infty)$; l) $(-\infty, \infty)$; m) $(-\frac{1}{2}, 3)$; n) $(-\infty, -2) \cup (1, 4]$; o) $[-5, 5) \cup (6, \infty)$; p) $(4, 12)$.
4. $(x-1)^2 + (y-3)^2 = 10$
5. $a = 9; b = 21$.
6. (a). x-int. $(-1, 0)$ and $(1, 0)$,
no y-int., symmetry about the origin. (b). x-int. $(4.5, 0)$, y-int. $(0, 3)$
no symmetry

7. a)



b)



8. a) 3, b) $-2x-1$.

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

10. $(-\sqrt{5}, 0), (\sqrt{5}, 0)$.

11. a). $-\frac{1}{2}$ or $\frac{5}{6}$; b) $\frac{11}{4}$ or $\frac{3}{2}$.

12. a) $\frac{x^2+x+1}{x+3}$; b) $5x-18$; c) $-(\sqrt{2} + \sqrt{5})$; d) $\frac{1}{\sqrt{4+x+2}}$; e) $\frac{\sqrt{4x+1}+3}{4}$; f) $\frac{x-4}{\sqrt{x^2+9}+5}$; g) $\frac{x-2}{x+1}, x \neq 2/3$;

h) $\frac{2x-3}{x-7}, x \neq -3$.

13. a) $-\frac{1}{x+8}$; b) $\frac{x^3}{(x-1)^2}$; c) $4(x+2)$; d) $3h^2 + h - 7$.

14. a) $\frac{3(x+10)}{(x-3)(x+8)}$; b) $\frac{x-12}{2x-8}$; c) $\frac{1}{x+6}$; d) $\frac{2x^2 - x + 14}{(x-4)(x+3)}$.

15. $(x+3)^2 + (y+\frac{9}{2})^2 = \frac{117}{4}$.

16. $(x-1)^2 + (y-6)^2 = 8$.

17. $(x-2)^2 + (y-5)^2 = 25$.

18. a) x-int. $(-14, 0)$; y-int: $(0, -\sqrt{7}), (0, \sqrt{7})$; b) x-int: $(4 - 2\sqrt{3}, 0), (4 + 2\sqrt{3}, 0)$, y-int $(0, -2)$.

19. $(0, 5 - 4\sqrt{2}), (0, 5 + 4\sqrt{2})$.