1.3 Linear Equations in Two Variables

Vocab
slope ⇒
linear equation in two variables ⇒
parallel lines ⇒
perpendicular lines ⇒
linear extrapolation ⇒
linear interpolation ⇒

Formulas
slope

Lines
Point-slope form
slope-intercept form
vertical line:
horizontal line:
perpendicular slopes
parallel slopes
1.3 (cont) 

slopes

positive → negative

zero → undefined

Ex 1  Find slope and y-intercept of these lines.

(a) \( y = \frac{-3}{2} x + 4 \)

(b) \( 2x + 3y = 9 \)

(c) \( x - 5 = 0 \)

(d) \( y = 3 \)

Ex 2  Find the slope of the line between \( \left( \frac{1}{8}, \frac{3}{4} \right) \) and \( \left( \frac{5}{4}, \frac{1}{4} \right) \).
1.3 (cont)

Ex. 3  Find Eqn of line w/ the given information.

(a) through (-1, -6) w/ \( m = -\frac{1}{2} \)

(b) thru (-10, 1) w/ undefined slope

(c) through pts (1, 1) and (6, -\(\frac{3}{2} \)).
1.3 (cont)

Ex 4 Write the equation of a line through \((-5,1)\) and (perpendicular) to the line \(2x-3y=6\).

Ex 5 Find an equation that relates \(x\) and \(y\) such that the point \((x,y)\) is equidistant from the two pts \((-\frac{1}{2}, -4)\) and \((\frac{3}{2}, \frac{5}{2})\).
1.4 Functions

Vocab

function ⇒ (notation f(x))

domain ⇒ (implied domain)

range ⇒

(see characteristics pg 40 of book)

independent variable

dependent variable

Ex 1 Are these relationships functions?

(a)  domain range
    Bob  → 14
    Mark → 15
    Tom  → 16
    Sue  → 17
    Mary → 18
    Lisa → 19
    Anita → 20
    21
(b) Given \( A = \{1, 2, 3, 4, 5\} \) \( B = \{0, 10, 20, 30, 40, 50, 60\} \)
ordered pairs \( \{ (1, 30), (5, 10), (4, 50), (3, 10) \} \)

(c) \( 2y = \sqrt{x-1} \)

(d) \( x - 3 = y^2 \)

(e) \( x^2 + y^2 = 10 \)

Ex 2  Evaluate for \( f(x) = \sqrt{x+8} + 2 \)

(a) \( f(-8) \)
1.4 (cont)

Ex 2 (cont)

(6) \( f(x-8) \)

(6) \( f(1) \)

Ex 3  Given \( f(x) = \begin{cases} 9-x^2, & x < 3 \\ x-3, & x \geq 3 \end{cases} \)

fill in table.

<table>
<thead>
<tr>
<th>( x )</th>
<th>( f(x) )</th>
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<tbody>
<tr>
<td>1</td>
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<td>5</td>
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Ex 4 Find domain for these functions.

(a) \( f(t) = \sqrt[3]{t+4} \)

(b) \( h(x) = \frac{10}{x^2 - 2x} \)

(c) \( f(x) = \frac{\sqrt{x+1}}{b+x} \)

Ex 5 For \( f(x) = 4x^2 - 2x \), find \( \frac{f(x+h) - f(x)}{h} \) \((h \neq 0)\)
1.5 Analyzing Graphs of Functions

Vocabulary:

- **Zeros of a function** (a.k.a. roots) all \( x \)-values \( x \) \( \in \) \( f(x) = 0 \).

\[ \uparrow \]

\[ \downarrow \]

- **Increasing** \( a \) \( f \) is increasing if for all \( x_1, x_2 \) \( \in \) \( f(x_1) < f(x_2) \).

- **Decreasing**

- **Constant**

Processes:

1. **Vertical Line Test**

\[ \text{avg rate of change} \]

\[ \text{relative minimum} \Rightarrow f(a) \text{ is rel. min. for } f(x) \text{ if } \exists (x_1, x_2) \]
\[ a \in (x_1, x_2) \text{ and } x_1 < x < x_2 \Rightarrow f(a) \leq f(x) \]

\[ \text{relative maximum} \Rightarrow \]

**Even function**

\[ f(-x) = f(x) \quad \forall x \]

**Odd function**

\[ f(-x) = -f(x) \quad \forall x \]
Ex 1 Use this graph to answer the questions.

(a) What is domain and range?

(b) Find $f(-7)$

(c) $f(2)$

(d) What are the zeros (roots) of $f(x)$?

(e) Is this a function?

(f) Determine intervals where $f(x)$ is
   • increasing
   • decreasing
   • constant

Ex 2 Find the zeros of $f(x) = \frac{x^2 - 9x + 14}{4x}$
1.5 (cont)

Ex 3 Determine if \( f(x) \) is even or odd or neither.

(a) \( f(x) = x^3 - 7x \)

(b) \( f(x) = x^4 + 2x^2 - \sqrt{1 - x^2} \)

(c) \( f(x) = 2x^5 - 9 \)

Ex 4 Graph \( f(x) = x^2 - 4x \).
Ex 5 Find the average rate of change of \( f(x) \) from \( x_1 \) to \( x_2 \).

(a) \( f(x) = x^2 - 2x + 8 \) \( x_1 = 1, \ x_2 = 5 \)

(b) \( f(x) = -\sqrt{x+1} + 3 \) \( x_1 = 3, \ x_2 = 8 \)