

Section 1.1 - 1.5

Linear Equations and Linear Inequalities

1) $\frac{1}{4}x = \frac{3}{20}$

Multiply all by 20 $5x = 3$ $x = \frac{3}{5}$

2) $3t - 4 = 24 - t$

$4t = 28$ $x = 7$

3) $1 + 6n = 9n + 4$

$-3n = 3$ $x = -1$

4) $3x - (4x + 9) = 2x - 12$

$3x - 4x - 9 = 2x - 12$

$-x - 9 = 2x - 12$

$-3x = -3$

$x = 1$

5) An equation of the form $ax + b = 0$ is called a **linear** equation or a **first degree**.

6) $\frac{5}{3}x + 4 = \frac{1}{3} + \frac{1}{3}x$

Multiply all by 3

$5x + 12 = 1 + x$

$4x = -11$ $x = \frac{-11}{4}$

7) $\frac{2}{3}x - 3 = \frac{5}{6}x$

Multiply all by 6

$4x - 18 = 5x$

$-x = 18$

$x = 18$

8) $\frac{3}{4}p = \frac{4}{5}p + \frac{3}{2}$

Multiply all by 20

$15p = 16p + 30$

$-p = 30$ $p = -30$

9) $0.4t = 0.3 + 0.5t$

Multiply all by 10 $4t = 3 + 5t$

$-t = 3$

$t = -3$

$$10) \quad \frac{x+1}{4} + \frac{x+2}{7} = 1$$

Multiply all by 28 $7x + 7 + 4x + 8 = 28$

$$11x + 15 = 28 \quad 11x = 13 \quad x = \frac{13}{11}$$

$$11) \quad (x+10)(x-4) = (x+2)^2 \quad \text{foil left side and square the right side}$$

$$x^2 - 4x + 10x - 40 = x^2 + 4x + 4$$

$$6x - 40 = 4x + 4$$

$$2x = 44 \quad x = 22$$

$$12) \quad x(2x-3) = (2x+4)(x-7)$$

multiply both sides out

$$2x^2 - 3x = 2x^2 - 14x + 4x - 28$$

$$-3x = -10x - 28$$

$$7x = -28 \quad x = -4$$

$$13) \quad z(z^4 + 1) = 2 + z^5 \quad \text{distribute left side}$$

$$z^5 + z = 2 + z^5$$

$$z = 2$$

$$14) \quad ax - b = c \quad \text{solve for } x$$

$$ax = b + c$$

$$x = \frac{b+c}{a}$$

$$15) \quad \frac{2x}{b} - \frac{x}{a} = c \quad \text{solve for } x$$

Multiply all by **ab**

$$2xa - xb = abc$$

Factor out the x

$$x(2a-b) = abc$$

divide to get x by itself

$$x = \frac{abc}{2a-b}$$

16) Todd is paid time-and-a-half over 40 hours. If he grosses \$345 for 44 hours, what is his regular hourly rate?

$$44 - 40 = 4$$

Let $x = \text{hourly rate}$

$$40x + 4(1.5x) = 345$$

$$40x + 6x = 345 \quad x = \$7.50$$

17) Going into a final exam which will count as **two tests**, Shawn has test scores 79, 80, 70, 65, and 96. What score does he need to make on the final to average and 80?

The average is the sum divided by the number of items (7 scores)

$$\frac{79+80+70+65+96+2x}{7} = 80$$

$$2x + 390 = 560$$

$$2x = 170 \quad x = 85$$

18) A builder **reduced** the price of a house by 15%. If the new price is \$595,000, what was the original price?

$$\text{Let } x = \text{original price} \quad x - 0.15x = 595,000 \quad 0.85x = 595,000 \quad x = \$700,000$$

* divide \$ by (1-%)

19) A college bookstore **marks up** the book price by 25%. If they sell that book for \$81.00, what did they pay for the book?

$$\text{Let } x = \text{original price} \quad x + 0.25x = 81 \quad 1.25x = 81 \quad x = \$64.80$$

* divide \$ by (1+%)

20)) The perimeter of a window is 42 feet. The width is 5 feet more than the length, what are the dimensions?

$$P = 2l + 2w$$

$$w = 5 + l$$

l is length and w is width

$$42 = 2l + 2(5 + l)$$

$$42 = 2l + 10 + 2l$$

$$42 = 4l + 10$$

$$32 = 4l$$

$$l = 8 \text{ and } w = 13$$

< > means () ≤ ≥ means []

21) Express the graph shown in color using interval notation. Also express it as an inequality involving x.

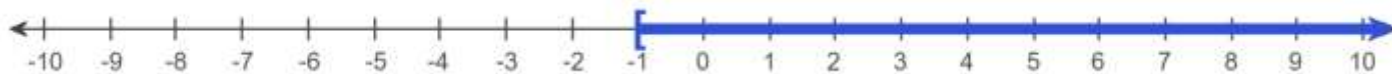


Use interval notation to describe the graph. What is the resulting interval?

Interval Notation [2,6]

Inequality Notation $2 \leq x \leq 6$

22) Express the graph shown in color using interval notation. Also express the graph as an inequality involving x.



Interval Notation $[-1, \infty)$

Inequality Notation $x \geq -1$

right arrow ∞), left arrow $(-\infty$
arrow points same as graph

23) $-2 \leq x \leq 8$ Interval notation $[-2, 8]$

24) $x > 1$ Interval notation $(1, \infty)$

25) $\frac{1}{6}(x - 15) < x + 20$ multiply the right side by 6 to eliminate fraction

$$x - 15 < 6x + 120$$

$$-5x < 135 \quad \text{switch inequality when dividing by negative}$$

$$\{x | x > -27\} \text{ or } (-27, \infty)$$

26) $0 \leq 2x - 8 \leq 6$ Solve the middle for x add 8 to all 3 parts

$$8 \leq 2x \leq 14 \quad \text{divide by 2 to all 3 parts}$$

$$\text{Inequality notation } \{x | 4 \leq x \leq 7\} \quad \text{Interval Notation } [4, 7]$$

Extra Examples

$$27) \frac{x}{x-2} + 3 = \frac{2}{x-2}$$

Multiply all by (x-2) $x + 3x - 6 = 2$

$$4x = 8$$

$x = 2$; however, that will make the

denominator zero and that is undefined so the answer is

NO SOLUTION

$$28) \frac{2x}{x^2-4} = \frac{4}{x^2-4} - \frac{2}{x+2}$$

Multiply all by (x^2-4) same as $(x-2)(x+2)$

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

$$2x = 4 - 2x + 4$$

$4x = 8$; however that will make the

denominator zero and that is undefined so the answer is

NO SOLUTION

$$29) \frac{x}{x+4} = \frac{7}{6}$$

Cross multiply to get $7x + 28 = 6x$

$$x = -28$$

$$30) \frac{6t+7}{4t-7} = \frac{3t+7}{2t-5}$$

Cross multiply $(6t+7)(2t-5) = (4t-7)(3t+7)$

$$12t^2 - 16t - 35 = 12t^2 + 7t - 49$$

$$-23t = -14 \quad x = \frac{14}{23}$$

$$31) \frac{5}{x-3} = \frac{-4}{x+5} + \frac{31}{(x-3)(x+5)}$$

Multiply all by $(x-3)(x+5)$

$$5(x+5) = -4(x-3) + 31$$

$$5x+25 = -4x+43 \quad 9x = 18 \quad x = 2$$

$$32) \frac{x}{x^2-1} - \frac{x+3}{x^2-x} = \frac{-3}{x^2+x}$$

$(x-1)(x+1) \quad x(x-1) \quad x(x+1)$

Factor each denominator

Multiply all by $x(x-1)(x+1)$

$x(x) - (x+3)(x+1) = -3(x-1)$ *distribute the negative in the foil part*

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

$$-4x - 3 = -3x + 3$$

$$-x = 6$$

$$x = -6$$

33) $\frac{1}{s} + \frac{1}{p} = \frac{1}{g}$ solve for g Multiply all by **spg** $pg + sg = sp$

Factor out the g $g(p+s) = ps$ divide to get g by itself $g = \frac{ps}{p+s}$

34) $D = \frac{pz^3}{T}$ solve for T Multiply both by **T** $DT = pz^3$

Divide by D $T = \frac{pz^3}{D}$

35) $(8x+4)^{-1} < 0$ Negative exponent makes a fraction

$\frac{1}{8x+4} < 0$ $8x+4 < 0$ then $x < -\frac{1}{2}$

Inequality notation $x < -\frac{1}{2}$

Interval Notation $(-\infty, -\frac{1}{2})$

36) $(8x+4)^2 < 0$ Square can never be negative therefore **NO SOLUTION**

37) $(8x+4)^{-2} > 0$ Square will always be positive therefore **ALL REALS**

38) Domain of $\sqrt{6x+30}$ Cannot have negative under the radical

$6x + 30 \geq 0$

$x \geq -5$

39) $\frac{1}{2}x + \frac{1}{3}x - \frac{1}{5}(x+6) \leq \frac{1}{10}$ multiply all by 30 (common denominator)

$15x + 10x - 6(x+6) \leq 3$ $19x \leq 39$ $x \leq \frac{39}{19}$

Interval Notation $(-\infty, \frac{39}{19})$ Inequality notation $x \leq \frac{39}{19}$

40) $-2(3x-4) > 20$ Solve for x as a normal equation

$-6x + 8 > 20$

$-6x > 12$ switch inequality when dividing by negative

$x < -2$

Inequality notation $\{x | x < -2\}$

Interval Notation $(-\infty, -2)$