

# Math 135 – Intermediate Algebra

## Homework 1 – Solutions

October 2, 2007

All problems are from section 2.1 of Akst & Bragg.

### Problems 1 to 9

*Determine whether the given value is a solution of the equation.*

1. Equation:  $2x - 1 = 5$  and Value: 2

$$\begin{aligned} 2(2) - 1 &\stackrel{?}{=} 5 \\ 4 - 1 &\stackrel{?}{=} 5 \\ 3 &\stackrel{?}{=} 5 \end{aligned}$$

Since  $3 \neq 5$ , 2 **is not a solution** of the equation  $2x - 1 = 5$ .

3. Equation:  $1 - \frac{t}{4} = -2$  and Value:  $-4$

$$\begin{aligned} 1 - \frac{-4}{4} &\stackrel{?}{=} -2 \\ 1 + \frac{4}{4} &\stackrel{?}{=} -2 \\ 1 + 1 &\stackrel{?}{=} -2 \\ 2 &\stackrel{?}{=} -2 \end{aligned}$$

Since  $2 \neq -2$ ,  $-4$  **is not a solution** of the equation  $1 - \frac{t}{4} = -2$ .

5. Equation:  $5y - 6 = 7y - 5$  and Value:  $-\frac{1}{2}$

$$\begin{aligned} 5\left(-\frac{1}{2}\right) - 6 &\stackrel{?}{=} 7\left(-\frac{1}{2}\right) - 5 \\ -\frac{5}{2} - 6 &\stackrel{?}{=} -\frac{7}{2} - 5 \\ \frac{5}{2} + 6 &\stackrel{?}{=} \frac{7}{2} + 5 \\ \frac{5}{2} + \frac{12}{2} &\stackrel{?}{=} \frac{7}{2} + \frac{10}{2} \\ \frac{17}{2} &\stackrel{?}{=} \frac{17}{2} \end{aligned}$$

Since  $\frac{17}{2} = \frac{17}{2}$ ,  $-\frac{1}{2}$  **is a solution** of the equation  $5y - 6 = 7y - 5$ .

7. Equation:  $2n - 10 = 4(3n - 15)$  and Value: 7

$$\begin{aligned} 2(7) - 10 &\stackrel{?}{=} 4(3(7) - 15) \\ 14 - 10 &\stackrel{?}{=} 4(21 - 15) \\ 4 &\stackrel{?}{=} 4(6) \\ 4 &\stackrel{?}{=} 24 \end{aligned}$$

Since  $4 \neq 24$ , 7 **is not a solution** of the equation  $2n - 10 = 4(3n - 15)$ .

9. Equation:  $\frac{1}{2}\left(9 - \frac{x}{4}\right) + x = \frac{x}{3} - 2$  and Value:  $-12$

$$\frac{1}{2}\left(9 - \frac{-12}{4}\right) + (-12) \stackrel{?}{=} \frac{-12}{3} - 2$$

$$\frac{1}{2}\left(9 + \frac{12}{4}\right) - 12 \stackrel{?}{=} -4 - 2$$

$$\frac{1}{2}(9 + 3) - 12 \stackrel{?}{=} -6$$

$$\frac{1}{2}(12) - 12 \stackrel{?}{=} -6$$

$$6 - 12 \stackrel{?}{=} -6$$

$$-6 \stackrel{?}{=} -6$$

Since  $-6 = -6$ ,  $-12$  is a **solution** of the equation  $\frac{1}{2}\left(9 - \frac{x}{4}\right) + x = \frac{x}{3} - 2$ .

### Problems 11 to 31

*Solve and check.*

11. Equation:  $x + 4 = 2$

$$x + 4 = 2$$

$$x = 2 - 4$$

$$x = -2$$

13. Equation:  $x - 3.7 = -2$

$$x - 3.7 = -2$$

$$x = -2 + 3.7$$

$$x = 1.7$$

15. Equation:  $\frac{3}{4} + y = -\frac{5}{8}$

$$\frac{3}{4} + y = -\frac{5}{8}$$

$$y = -\frac{5}{8} - \frac{3}{4}$$

$$y = -\frac{5}{8} - \frac{6}{8}$$

$$y = -\frac{11}{8}$$

17. Equation:  $\frac{n}{5} = -1$

$$\frac{n}{5} = -1$$

$$n = -5$$

**19.** Equation:  $16 - 4y = 0$

$$\begin{aligned}16 - 4y &= 0 \\16 &= 4y \\ \frac{16}{4} &= \frac{4y}{4} \\4 &= y \\y &= 4\end{aligned}$$

**21.** Equation:  $\frac{2}{3}n = \frac{4}{9}$

$$\begin{aligned}\frac{2}{3}n &= \frac{4}{9} \\n &= \frac{4}{9} \cdot \frac{3}{2} \\n &= \frac{12}{18} \\n &= \frac{2}{3}\end{aligned}$$

**23.** Equation:  $-8.1 = 0.9a$

$$\begin{aligned}-8.1 &= 0.9a \\ \frac{-8.1}{0.9} &= \frac{0.9a}{0.9} \\ \frac{-81}{9} &= a \\a &= -9\end{aligned}$$

**25.** Equation:  $5x + 1 = -4$

$$\begin{aligned}5x + 1 &= -4 \\5x &= -4 - 1 \\5x &= -5 \\x &= -1\end{aligned}$$

**27.** Equation:  $12 - x = -10$

$$\begin{aligned}12 - x &= -10 \\-x &= -10 - 12 \\-x &= -22 \\x &= 22\end{aligned}$$

**29.** Equation:  $-4n - 6 = 10$

$$\begin{aligned}-4n - 6 &= 10 \\ -4n &= 10 + 6 \\ -4n &= 16 \\ n &= \frac{16}{-4} \\ n &= -4\end{aligned}$$

**31.** Equation:  $9 + 8n = 9$

$$\begin{aligned}9 + 8n &= 9 \\ 8n &= 9 - 9 \\ 8n &= 0 \\ n &= 0\end{aligned}$$

**Problems 39 to 53**

*Solve and check.*

**39.** Equation:  $8y = y$

$$\begin{aligned}8y &= y \\ 8y - y &= 0 \\ 7y &= 0 \\ y &= 0\end{aligned}$$

**41.** Equation:  $10 - 5x = x + 18$

$$\begin{aligned}10 - 5x &= x + 18 \\ -5x - x &= 18 - 10 \\ -6x &= 8 \\ x &= -\frac{8}{6} \\ x &= -\frac{4}{3}\end{aligned}$$

**43.** Equation:  $7y - 8 = 12y - 8$

$$\begin{aligned}7y - 8 &= 12y - 8 \\ 7y - 12y &= -8 + 8 \\ -5y &= 0 \\ y &= 0\end{aligned}$$

45. Equation:  $8a - 3 - 5a = 15$

$$\begin{aligned}8a - 3 - 5a &= 15 \\3a &= 15 + 3 \\3a &= 18 \\a &= \frac{18}{3} \\a &= 6\end{aligned}$$

47. Equation:  $16n = 7n - 15 - 6n$

$$\begin{aligned}16n &= 7n - 15 - 6n \\16n &= n - 15 \\16n - n &= -15 \\15n &= -15 \\n &= -1\end{aligned}$$

49. Equation:  $2.4 - 0.6x + 3.3 = 1.3x$

$$\begin{aligned}2.4 - 0.6x + 3.3 &= 1.3x \\5.7 - 0.6x &= 1.3x \\-0.6x - 1.3x &= -5.7 \\0.6x + 1.3x &= 5.7 \\1.9x &= 5.7 \\x &= \frac{5.7}{1.9} \\x &= 3\end{aligned}$$

51. Equation:  $18 - 12n = 16 + 3n - 11$

$$\begin{aligned}18 - 12n &= 16 + 3n - 11 \\18 - 12n &= 5 + 3n \\-12n - 3n &= 5 - 18 \\-15n &= -13 \\15n &= 13 \\n &= \frac{13}{15}\end{aligned}$$

53. Equation:  $23t + 11 - 15t = 6t - 18 + 7$

$$\begin{aligned}23t + 11 - 15t &= 6t - 18 + 7 \\8t + 11 &= 6t - 11 \\8t - 6t &= -11 - 11 \\2t &= -22 \\t &= \frac{-22}{2} \\t &= -11\end{aligned}$$

**Problems 59 to 69***Solve and check.*

**59.** Equation:  $-2(x - 6) = 4$

$$\begin{aligned}-2(x - 6) &= 4 \\ -2x + 12 &= 4 \\ -2x &= 4 - 12 \\ -2x &= -8 \\ 2x &= 8 \\ x &= \frac{8}{2} \\ x &= 4\end{aligned}$$

**61.** Equation:  $7 - (3n - 8) = -6$

$$\begin{aligned}7 - (3n - 8) &= -6 \\ 7 - 3n + 8 &= -6 \\ 15 - 3n &= -6 \\ -3n &= -6 - 15 \\ -3n &= -21 \\ 3n &= 21 \\ n &= \frac{21}{3} \\ n &= 7\end{aligned}$$

**63.** Equation:  $-4(7 + 3x) = -5(2x + 8)$

$$\begin{aligned}-4(7 + 3x) &= -5(2x + 8) \\ -28 - 12x &= -10x - 40 \\ -12x + 10x &= -40 + 28 \\ -2x &= -12 \\ 2x &= 12 \\ x &= \frac{12}{2} \\ x &= 6\end{aligned}$$

**65.** Equation:  $\frac{1}{2}(16n - 12) = 9n + 11$

$$\begin{aligned}\frac{1}{2}(16n - 12) &= 9n + 11 \\ \frac{16n}{2} - \frac{12}{2} &= 9n + 11 \\ 8n - 6 &= 9n + 11 \\ 8n - 9n &= 11 + 6 \\ -n &= 17 \\ n &= -17\end{aligned}$$

**67.** Equation:  $5x - 2(x + 6) = 6(x - 1) - 8$

$$\begin{aligned}5x - 2(x + 6) &= 6(x - 1) - 8 \\5x - 2x - 12 &= 6x - 6 - 8 \\3x - 12 &= 6x - 14 \\3x - 6x &= -14 + 12 \\-3x &= -2 \\3x &= 2 \\x &= \frac{2}{3}\end{aligned}$$

**69.** Equation:  $13 - 9(2n + 3) = 4(6n + 1) - 15n$

$$\begin{aligned}13 - 9(2n + 3) &= 4(6n + 1) - 15n \\13 - 18n - 27 &= 24n + 4 - 15n \\-14 - 18n &= 9n + 4 \\-14 - 4 &= 9n + 18n \\-18 &= 27n \\\frac{-18}{27} &= n \\-\frac{2}{3} &= n \\n &= -\frac{2}{3}\end{aligned}$$

**Problem 81**

*The cost of a book at an online discount book retailer is 20% less than the list price of the book. The total cost to purchase the book online is \$33.59, which includes a shipping fee of \$3.99.*

**a.** *What is the original list price of the book?*

Let  $L$  be the original List price of the book. We can write the equation:

$$\left(1 - \frac{20}{100}\right)L + 3.99 = 33.59$$

which we can solve to find  $L$ :

$$\begin{aligned}\left(1 - \frac{20}{100}\right)L + 3.99 &= 33.59 \\\frac{80}{100}L &= 33.59 - 3.99 \\\frac{4}{5}L &= 29.6 \\L &= \frac{5}{4}29.6 \\L &= 37\end{aligned}$$

The original list price of the book is \$37.

*b. Excluding the shipping fee, how much money was saved purchasing the book online?*

Let  $A$  be the Amount of money saved by purchasing the book online,  $S$  the Shipping fee and  $T$  the Total cost to purchase the book online. We have:

$$A = L - (T - S)$$

which we can rewrite:

$$A = 37 - (33.59 - 3.99)$$

$$A = 37 - 29.6$$

$$A = 7.4$$

\$7.40 were saved purchasing the book online.
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*c. If the shipping fee is included, what was the actual percent discount off the original list price?*

Let  $D$  be the actual percent Discount when the shipping fee is included.

$$37(1 - D) = 33.59$$

$$1 - D = \frac{33.59}{37}$$

$$1 - D \simeq 0.91$$

$$-D \simeq -0.09$$

$$D \simeq 0.09$$

When the shipping fee is taken into account, the actual discount is only about 9%.
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### Problem 83

*There are 10 equally spaced hurdles in the women's 400-meter hurdle track event. The distance from the starting line to the first hurdle is 45 m and the distance from the last hurdle to the finish line is 40 m. What is the distance between the hurdles?*

Let  $d$  be the distance between the hurdles. As there are 10 equally spaced hurdles, the distance between the first one and the last one is  $9d$ . Thus,

$$45 + 9d + 40 = 400$$

which we can solve to find  $d$ :

$$45 + 9d + 40 = 400$$

$$85 + 9d = 400$$

$$9d = 400 - 85$$

$$9d = 315$$

$$d = \frac{315}{9}$$

$$d = 35$$

The distance between two hurdles is 35 m.
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**Problem 85**

A telephone company offers two plans for local and long-distance calling. Plan A costs a flat fee of \$39.95 per month for unlimited local and long-distance calling. Plan B costs \$14.95 for unlimited local calling and \$4 plus an additional \$0.07 per minute for long-distance calling per month. For what number of minutes will the monthly cost of Plan B be the same as the monthly cost of Plan A?

Let  $m$  be the number of minutes for which the monthly costs of Plan A and Plan B are the same. We have:

$$14.95 + 4 + 0.07m = 39.95$$

which we can solve to find  $m$ :

$$\begin{aligned} 14.95 + 4 + 0.07m &= 39.95 \\ 18.95 + 0.07m &= 39.95 \\ 0.07m &= 39.95 - 18.95 \\ 0.07m &= 21 \\ m &= \frac{21}{0.07} \\ m &= \frac{2100}{7} \\ m &= 300 \end{aligned}$$

The cost of Plan A and Plan B will be the same for 300 min of long-distance calls.

**Problem 87**

An interior designer has small and large throw pillows made for a family room. The small pillows require  $1/2$  sq yd of fabric and the large pillows require 2 sq yd of fabric. If 18 sq yd of fabric are used to make 18 pillows, how many of each type of pillow are made for the family room?

Let  $s$  be the number of small pillows and  $\ell$  the number of large pillows that were made for the family room. 18 pillows were made, therefore  $s = 18 - \ell$ . Moreover, 18 sq yd of fabric were used, which yields:

$$\frac{1}{2}s + 2\ell = 18$$

Using the relation between  $s$  and  $\ell$  given above, this can be written:

$$\begin{aligned} \frac{1}{2}(18 - \ell) + 2\ell &= 18 \\ \frac{18}{2} - \frac{\ell}{2} + 2\ell &= 18 \\ 9 - \frac{\ell}{2} + \frac{4\ell}{2} &= 18 \\ 9 + \frac{3\ell}{2} &= 18 \\ \frac{3\ell}{2} &= 18 - 9 \\ \frac{3\ell}{2} &= 9 \\ \ell &= 9 \cdot \frac{2}{3} \\ \ell &= 6 \end{aligned}$$

As  $s = 18 - \ell$ , 12 small pillows and 6 large ones were made for the family room.

**Problem 95**

The AIDS Walk is an annual 10-km walkathon held in various cities throughout the United States. If a participant walks at an average of 4 km per hour, how long will it take her to finish the walkathon?

Let  $t$  be the time the participant needs to walk 10 km at 4 km per hour. It comes:

$$\begin{aligned} 4t &= 10 \\ t &= \frac{10}{4} \\ t &= 2.5 \end{aligned}$$

It will take 2 and a half hours for the participant to finish the walkathon.

**Problem 97**

Fifteen minutes after a boy left for school on his bike, his mother noticed that he had left his term paper on the kitchen table. His mother left home, driving at a rate of 32 mph, to catch up with him. If he had been bicycling at a rate of 8 mph, how long did it take his mother to catch up with him?

Let  $t$  be the time the boy's mother needed to catch up with him. Noticing that 15 minutes is  $1/4$  of an hour, we have:

$$\begin{aligned} 32t &= 8 \left( \frac{1}{4} + t \right) \\ 32t &= \frac{8}{4} + 8t \\ 32t - 8t &= 2 \\ 24t &= 2 \\ t &= \frac{2}{24} \\ t &= \frac{1}{12} \end{aligned}$$

$t$  is therefore  $1/12$  of an hour, or 5 min.

**Problem 103**

A sales representative invests his \$12,000 bonus in two mutual funds. After 1 year, one fund made a 7% profit and the other lost 9%. If the total profit on the investments was \$200, how much did he invest in each mutual fund?

Let  $a$  be the amount the sales representative invested in the profitable mutual fund. It comes:

$$\begin{aligned} \frac{7}{100}a - \frac{9}{100}(12000 - a) &= 200 \\ \frac{7+9}{100}a - 12000 \frac{9}{100} &= 200 \\ \frac{4}{25}a - 1080 &= 200 \\ \frac{4}{25}a &= 200 + 1080 \\ \frac{4}{25}a &= 1280 \\ a &= 1280 \frac{25}{4} \\ a &= 8000 \end{aligned}$$

The sales representative invested \$8,000 in the profitable fund and  $\$12,000 - \$8,000 = \$4,000$  in the other one.