More Systems of Equations
Purchases, Printing Press, and Current Travel
Unit 5: Real World Applications

Solve each question. Round your answer to the nearest hundredth when needed.

1. Mia spent $177 on books. Math books cost $25 and English books cost $26. If she bought a total of 7 books, then how many of each kind did she buy?

   5 math books

   2 English books

2. Joe spent $320 on books. Math books cost $50 and science books cost $60. If he bought a total of 6, then how many of each kind did he buy?

   4 math books

   2 science books

3. Heather spent $150 on shirts. Fancy shirts cost $21 and plain shirts cost $15. If she bought a total of 8, then how many of each kind did she buy?

   5 fancy shirts

   3 plain shirts

4. Jack spent $52 on shirts. Tee shirts cost $4 and long sleeve shirts cost $8. If he bought a total of 8, then how many of each kind did he buy?

   3 tee shirts

   5 long sleeve shirts

5. Perry's Printing Inc. has two types of printing presses: Model A and Model B. Model A can print 80 books per day and Model B can print 30 books per day. Altogether Perry has 11 printing presses. If he can print 680 books in a day, then how many of each press does he have?

   7 of Model A

   4 of Model B

6. At Willie's Printing Company LLC there are two kinds of printing presses: Model A which can print 40 books per day and Model B which can print 65 books per day. The company owns 16 total printing presses and this allows them to print 815 books per day. How many of each type of press do they have?

   9 of Model A

   7 of Model B

7. At John's Printing Company LLC there are two kids of printing presses: Model A which can print 40 books per day and Model B which can print 60 books per day. The company owns 9 total printing presses and this allows them to print 460 books per day. How many of each type of press do they have?

   4 of Model A

   5 of Model B

8. At Kali's Printing Company LLC there are two kinds of printing presses: Model A which can print 70 books per day and Model B which can print 60 books per day. The company owns 13 total printing presses and this allows them to print 860 books per day. How many of each type of press do they have?

   8 of Model A

   5 of Model B

9. Traveling with the current a certain boat went 15 mph. Against the same current it only went 3 mph. Find the current and the speed of the boat if there were no current.

Boat   9 mph

Current   6 mph

10. Traveling with the current a certain boat went 16 km/h. Against the same current it only went 2 km/h. Find the speed of the boat in still water and the speed of the current.

Boat   9 km/h

Current   7 km/h

11. Flying to Orlando with a tailwind a plane averaged 204 mph. On the return trip the plane only averaged 148 mph while flying back into the same wind. Find the speed of the wind and the speed of the plane in still air.

Plane   176 mph

Wind   28 mph

12. Flying to Berlin with a tailwind a plane averaged 236 mph. On the return trip the plan only averaged 184 mph while flying back into the same wind. What is the speed of the wind? How fast would the plane go if there were no wind?

Plane   210 mph

Wind   26 mph

13. A plane traveled 1008 miles each way to Lisbon and back. The trip there was with the wind. It took 6 hours. The trip back was into the wind. The trip back took 9 hours. Find the speed of the plane in still air and the speed of the wind.

Plane   140 mph

Wind   28 mph

14. A boat traveled 224 kilometers each way downstream and back. The trip downstream took 7 hours. The trip back took 14 hours. Find the speed of the boat in still water and the speed of the current.

Boat   24 Km/h

Current   8 Km/h

15. A boat traveled 60 kilometers each way downstream and back. The trip downstream took 3 hours. The trip back took 30 hours. What is the speed of the boat in still water? What is the speed of the current?

Boat   11 Km/h

Current   9 Km/h

16. A boat traveled 300 kilometers each way downstream and back. The trip downstream took 10 hours. The trip back took 15 hours. What is the speed of the boat in still water? What is the speed of the current?

Boat   25 Km/h

Current   5 Km/h

① Total Books $M + E = 7$

Cost Equation $25M + 26E = 177$

Method 1: Substitution

- Solve total book equation for either M or E.

$$M + E = 7$$
$$\underline{-E \quad -E}$$
$$M = 7 - E$$

- Replace M in the cost equation.

$$25M + 26E = 177$$
$$25(7-E) + 26E = 177$$
$$175 - 25E + 26E = 177$$
$$\underline{-175 \qquad\qquad -175}$$
$$\boxed{E = 2}$$

- Plug E into total books and solve for M

$$M + E = 7$$
$$M + 2 = 7$$
$$\underline{-2 \quad -2}$$
$$\boxed{M = 5}$$

Method 2: Elimination

- multiply total Books Equation by -25.

$$-25[M + E = 7] \cdot -25$$
$$-25M - 25E = -175$$

- Add to Cost Equation

$$25M + 26E = 177$$
$$\underline{-25M - 25E = -175}$$
$$\boxed{E = 2}$$

- Replace E in Total Books Equation and solve for M.

$$M + E = 7$$
$$M + 2 = 7$$
$$\underline{-2 \quad -2}$$
$$\boxed{M = 5}$$

$$\boxed{\begin{array}{l} 5 \text{ Math Books} \\ 2 \text{ English Books} \end{array}}$$

② Total Books $\qquad$ $M + \$ = 6$

Cost Equation $\qquad$ $50M + 60\$ = 320$

Method 1: Substitution

- Solve Total Equation for M or $\$$

$$M + \$ = 6$$
$$\underline{- \$ \quad -\$}$$
$$M = 6 - \$$$

- Replace M in the Cost Equation

$$50M + 60\$ = 320$$
$$50(6 - \$) + 60\$ = 320$$
$$300 - 50\$ + 60\$ = 320$$
$$300 + 10\$ = 320$$
$$\underline{-300 \qquad -300}$$
$$\frac{10\$}{10} = \frac{20}{10}$$
$$\boxed{\$ = 2}$$

- Replace $\$$ in total books equation and solve for M.

$$M + \$ = 6$$
$$M + 2 = 6$$
$$\underline{-2 \quad -2}$$
$$\boxed{M = 4}$$

Method 2: Elimination

- Multiply total books equation by -50.

$$-50[M + \$ = 6] -50$$
$$-50M - 50\$ = -300$$

- Add to cost equation

$$50M + 60\$ = 320$$
$$\underline{-50M - 50\$ = -300}$$
$$\frac{10\$}{10} = \frac{20}{10}$$
$$\boxed{\$ = 2}$$

- Replace $\$$ in total books equation and solve for M

$$M + \$ = 6$$
$$M + 2 = 6$$
$$\underline{-2 \quad -2}$$
$$\boxed{M = 4}$$

$$
\boxed{
\begin{array}{l}
4 \text{ Math Books} \\
2 \text{ Science Books}
\end{array}
}
$$

③ Total Shirts $F + P = 8$

Cost Equation $21F + 15P = 150$

Method 1: Substitution

- Solve total shirts equation for F or P

$$F + P = 8$$
$$\underline{\quad -P \quad -P}$$
$$F = 8 - P$$

- Replace F in the cost equation

$$21F + 15P = 150$$
$$21(8-P) + 15P = 150$$
$$168 - 21P + 15P = 150$$
$$\underline{-168 \qquad\qquad -168}$$
$$\frac{-6P}{-6} = \frac{-18}{-6}$$
$$\boxed{P = 3}$$

- Plug P into total shirts equation and solve for F.

$$F + P = 8$$
$$F + 3 = 8$$
$$\underline{\quad -3 \quad -3}$$
$$\boxed{F = 5}$$

Method 2: Elimination

- Multiply total shirts by -15.

$$-15[F + P = 8] \cdot -15$$
$$-15F - 15P = -120$$

- Add to Cost Equation

$$21F + 15P = 150$$
$$\underline{-15F - 15P = -120}$$
$$\frac{6F}{6} = \frac{30}{6}$$
$$\boxed{F = 5}$$

- Replace F in Total Shirts equation and solve for P

$$F + P = 8$$
$$5 + P = 8$$
$$\underline{-5 \qquad -5}$$
$$\boxed{P = 3}$$

$$\boxed{\begin{array}{l} 3 \text{ Plain Shirts} \\ 5 \text{ Fancy shirts} \end{array}}$$

④ Total Shirts $\qquad$ $T + L = 8$

Cost Equation $\qquad$ $4T + 8L = 52$

Method 1: Substitution

- Solve Total Shirts equation for T or L.

$$T + L = 8$$
$$\underline{\quad -L \quad -L \quad}$$
$$T = 8 - L$$

- Replace T in the cost equation

$$4T + 8L = 52$$
$$4(8 - L) + 8L = 52$$
$$32 - 4L + 8L = 52$$
$$\underline{-32 \qquad\qquad -32}$$
$$\frac{4L}{4} = \frac{20}{4}$$
$$\boxed{L = 5}$$

- Plug L into total shirts equation and solve for T.

$$T + L = 8$$
$$T + 5 = 8$$
$$\underline{\quad -5 \quad -5}$$
$$\boxed{T = 3}$$

Method 2: Elimination

- Multiply total shirts equation by -4

$$-4[T + L = 8] \cdot {}^{-4}$$
$$-4T - 4L = -32$$

- Add to Cost equation

$$4T + 8L = 52$$
$$\underline{-4T - 4L = -32}$$
$$\frac{4L}{4} = \frac{20}{4}$$
$$\boxed{L = 5}$$

- Replace L in total shirts equation and solve for T.

$$T + L = 8$$
$$T + 5 = 8$$
$$\underline{\quad -5 \quad -5}$$
$$\boxed{T = 3}$$

$$\boxed{\begin{array}{l} 3 \text{ Tee Shirts} \\ 5 \text{ Long Sleeve Shirts} \end{array}}$$

(5) Printing Presses $A + B = 11$

Books Equation $80A + 30B = 680$

Method 1: Substitution

- Solve Printing Presses Equation for A or B.

$$A + B = 11$$
$$\underline{ - B \quad - B}$$
$$A = 11 - B$$

- Replace A in the Books equation and solve for B.

$$80A + 30B = 680$$
$$80(11 - B) + 30B = 680$$
$$880 - 80B + 30B = 680$$
$$\underline{-880 \qquad\qquad -880}$$
$$\underline{-50B = -200}$$
$$-50 \qquad -50$$
$$\boxed{B = 4}$$

- Replace B into Printing Presses equation and solve for A.

$$A + B = 11$$
$$A + 4 = 11$$
$$\underline{\quad -4 \qquad -4}$$
$$\boxed{A = 7}$$

Method 2: Elimination

- Multiply Printing Presses Equation by −30.

$$-30\big[A + B = 11\big] \cdot -30$$
$$-30A - 30B = -330$$

- Add to Books Equation

$$80A + 30B = 680$$
$$\underline{-30A - 30B = -330}$$
$$\frac{50A}{50} \qquad = \frac{350}{50}$$
$$\boxed{A = 7}$$

- Replace A in Printing Presses equation and solve for B.

$$A + B = 11$$
$$7 + B = 11$$
$$\underline{-7 \qquad\qquad -7}$$
$$\boxed{B = 4}$$

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7 Model A Presses
4 Model B Presses

⑥ Printing Presses

$A + B = 16$

Books Equation

$40A + 65B = 815$

Method 1: Substitution

- Solve Printing Presses Equation and solve for A or B

$$A + B = 16$$
$$\underline{\quad -B \qquad -B \quad}$$
$$A = 16 - B$$

- Replace A in the Books Equation

$$40A + 65B = 815$$
$$40(16 - B) + 65B = 815$$

$$640 - 40B + 65B = 815$$
$$-640 \qquad\qquad -640$$
$$\overline{\qquad\qquad\qquad\qquad}$$
$$\frac{25B}{25} = \frac{175}{25}$$
$$\boxed{B = 7}$$

- Plug B into Printing Presses equation and solve for A.

$$A + B = 16$$
$$A + 7 = 16$$
$$-7 \qquad -7$$
$$\overline{\qquad\qquad}$$
$$\boxed{A = 9}$$

Method 2: Elimination

- Multiply Printing Presses equations by −40

$$-40[A + B = 16] \cdot -40$$
$$-40A - 40B = -640$$

- Add to the Books Equation

$$40A + 65B = 815$$
$$-40A - 40B = -640$$
$$\overline{\qquad\qquad\qquad\qquad}$$
$$\frac{25B}{25} = \frac{175}{25}$$
$$\boxed{B = 7}$$

- Replace B in Printing Presses equation and solve for A

$$A + B = 16$$
$$A + 7 = 16$$
$$-7 \qquad -7$$
$$\overline{\qquad\qquad}$$
$$\boxed{A = 9}$$

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9 Model A Presses
7 Model B Presses

(7) **Printing Presses**

Books Equation

$$A + B = 9$$
$$40A + 60B = 460$$

Method 1: Substitution

- Solve Printing Presses Equation for A or B

$$A + B = 9$$
$$\underline{ - B \quad -B}$$
$$A = 9 - B$$

- Replace A into Books Equation and solve for B.

$$40A + 60B = 460$$
$$40(9 - B) + 60B = 460$$

$$360 - 40B + 60B = 460$$
$$\underline{-360 \qquad\qquad -360}$$

$$\frac{20B}{20} = \frac{100}{20}$$

$$\boxed{B = 5}$$

- Plug B into equation solve for A above.

$$A = 9 - B$$
$$A = 9 - 5$$
$$\boxed{A = 4}$$

Method 2: Elimination

- Multiply Printing Presses Equation by -40

$$-40[A + B = 9] \cdot {}^{-}40$$
$$-40A - 40B = -360$$

- Add to Books Equation

$$40A + 60B = 460$$
$$-40A - 40B = -360$$
$$\underline{}$$
$$\frac{20B}{20} = \frac{100}{20}$$
$$\boxed{B = 5}$$

- Replace B in Printing Presses equation and solve for A.

$$A + B = 9$$
$$A + 5 = 9$$
$$\underline{ -5 \quad -5}$$
$$\boxed{A = 4}$$

$$\boxed{\begin{array}{l} 4 \text{ Model A Presses} \\ 5 \text{ Model B Presses} \end{array}}$$

⑧ Printing Presses

Books Equation

$$A + B = 13$$
$$70A + 60B = 860$$

Method 1: Substitution

- Solve Printing Presses Equation for A or B.

$$A + B = 13$$
$$ -B \quad -B$$
$$A = 13 - B$$

- Replace A in Books Equation and solve for B.

$$70A + 60B = 860$$
$$70(13-B) + 60B = 860$$
$$910 - 70B + 60B = 860$$
$$-910 -910$$
$$\frac{-10B}{-10} = \frac{-50}{-10}$$
$$\boxed{B = 5}$$

- Plug B into equation solved for A.

$$A + B = 13$$
$$A + 5 = 13$$
$$-5 \quad -5$$
$$\boxed{A = 8}$$

Method 2: Elimination

- Multiply Printing Presses Equation by -60.

$$-60\left[A + B = 13\right] \cdot -60$$
$$-60A - 60B = -780$$

- Add to Books Equation

$$70A + 60B = 860$$
$$-60A - 60B = -780$$
$$\frac{10A}{10} = \frac{80}{10}$$
$$\boxed{A = 8}$$

- Replace A in Printing Presses equation and solve for B.

$$A + B = 13$$
$$8 + B = 13$$
$$-8 \quad -8$$
$$\boxed{B = 5}$$

$$\boxed{\begin{array}{l} 8 \text{ Model A Presses} \\ 5 \text{ Model B Presses} \end{array}}$$

⑨ With the current $r + c = 15$

Against the current $r - c = 3$

All of these are set up perfectly for elimination.

$$r + c = 15$$
$$r - c = 3$$
$$\frac{2r}{2} = \frac{18}{2}$$
$$\boxed{r = 9}$$

using $r + c = 15$
$$9 + c = 15$$
$$-9 \quad\quad -9$$
$$\boxed{c = 6}$$

| Boat speed 9 mph | Current speed 6 mph |

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⑩ With the current $r + c = 16$

Against the current $r - c = 2$

$$\frac{2r}{2} = \frac{18}{2}$$
$$\boxed{r = 9}$$

using
$$r + c = 16$$
$$9 + c = 16$$
$$-9 \quad\quad -9$$
$$\boxed{c = 7}$$

| Boat speed 9 Km/h | Current speed 7 Km/h |

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⑪ With the wind $r + w = 204$

Against the wind $r - w = 148$

$$\frac{2r}{2} = \frac{352}{2}$$
$$\boxed{r = 176 \text{ mph}}$$

using $r + w = 204$
$$176 + w = 204$$
$$-176 \quad\quad -176$$
$$\boxed{w = 28}$$

| Plane speed 176 mph | Wind speed 28 mph |

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⑫ With the wind $r + w = 236$

Against the wind $r - w = 184$

$$\frac{2r}{2} = \frac{420}{2}$$
$$\boxed{r = 210}$$

Using
$$r + w = 236$$
$$210 + w = 236$$
$$-210 \quad\quad -210$$
$$\boxed{w = 26}$$

| Plane speed 210 mph | Wind speed 26 mph |

(13)

	R	·	T	=	D
With wind	r + c		6		1008
Against Wind	r − c		9		1008

For 13 − 18 write the two equations, then ÷ by the time. After doing so the problems are just like 9 − 12.

$$\frac{(r+c)(\cancel{6})}{\cancel{6}} = \frac{1008}{6}$$

$$r + c = 168$$

$$\frac{(r-c)(\cancel{9})}{\cancel{9}} = \frac{1008}{9}$$

$$r - c = 112$$

Plane speed	140 mph
Wind speed	28 mph

$$r + c = 168$$
$$r - c = 112$$
$$\frac{2r}{2} = \frac{280}{2}$$
$$\boxed{r = 140}$$

Using
$$r + c = 168$$
$$140 + c = 168$$
$$\underline{-140 \qquad -140}$$
$$\boxed{c = 28}$$

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(14)

	R	·	T	=	D
With Current	r + c		7		224
Against Current	r − c		14		224

$$\frac{(r+c)(7)}{7} = \frac{224}{7}$$

$$r + c = 32$$

$$\frac{(r-c)(14)}{14} = \frac{224}{14}$$

$$r - c = 16$$

Boat speed	24 Km/h
Current speed	8 Km/h

$$r + c = 32$$
$$r - c = 16$$
$$\frac{2r}{2} = \frac{48}{2}$$
$$\boxed{r = 24}$$

Using
$$r + c = 32$$
$$24 + c = 32$$
$$\underline{-24 \qquad -24}$$
$$\boxed{c = 8}$$

(15)

	R	·	T	=	D
With Current	r + c		3		60
Against Current	r − c		30		60

$$\frac{(r+c)(3)}{3} = \frac{60}{3}$$

$$r + c = 20$$

$$\frac{(r-c)(30)}{30} = \frac{60}{30}$$

$$r - c = 2$$

Boat speed 11 Km/h
Current speed 9 Km/h

$$r + c = 20$$
$$r - c = 2$$
$$\frac{2r}{2} = \frac{22}{2}$$
$$\boxed{r = 11}$$

Using r + c = 20
$$11 + c = 20$$
$$-11 \qquad -11$$
$$\boxed{c = 9}$$

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(16)

	R	·	T	=	D
With Current	r + c		10		300
Against Current	r − c		15		300

$$\frac{(r+c)(10)}{10} = \frac{300}{10}$$

$$r + c = 30$$

$$\frac{(r-c)(15)}{15} = \frac{300}{15}$$

$$r - c = 20$$

Boat Speed 25 Km/h
Current Speed 5 Km/h

$$r + c = 30$$
$$r - c = 20$$
$$\frac{2r}{2} = \frac{50}{2}$$
$$\boxed{r = 25}$$

Using r + c = 30
$$25 + c = 30$$
$$-25 \qquad -25$$
$$\boxed{c = 5}$$