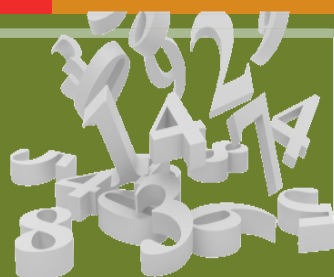


NUMERACY:

The Basics Workbook



Set W: Solving Equations 2

Companion Workbook to Numeracy: The Basics Video Series

Workplace Education Manitoba would like to express appreciation to the following for supporting the development of this curriculum:

The Government of Canada
Human Resource Skills Development Canada (HRSDC)

and

The Manitoba Government
Industry Workforce Development (IWD), Entrepreneurship,
Training and Trade (ETT)

Workplace Education Manitoba would also like to thank the individuals from across Manitoba who provided consultation, content, and feedback.

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ACKNOWLEDGMENTS





INTRODUCTION

What is Numeracy: The Basics Workbook?

This workbook is intended to accompany Workplace Education Manitoba's (WEM) Numeracy: The Basics Video Series, a set of 50 videos that explain essential numeracy concepts.

The refresher videos cover 25 critical numeracy topics, each broken into concept and practice.

The video series and accompanying downloadable workbooks can be found on the WEM website at http://www.wem.mb.ca/learning_on_demand.aspx

These Numeracy: The Basics workbooks provide an opportunity for additional skill-building practice.

Numeracy: The Basics topics are:

- Order of Operations 1
- Order of Operations 2
- Adding & Subtracting Fractions 1
- Adding & Subtracting Fractions 2
- Multiplying & Dividing Fractions
- Mixed & Improper Fractions
- Operations with Mixed Fractions 1
- Operations with Mixed Fractions 2
- Operations with Mixed Fractions 3
- Adding & Subtracting Decimals
- Multiplying Decimals
- Dividing Decimals
- Order of Operations & Decimals
- Decimals, Fractions & Percent 1
- Decimals, Fractions & Percent 2
- Imperial Conversions
- Metric Conversions
- Metric and Imperial Conversions
- Geometry 1 – Perimeter
- Geometry 2 – Area
- Geometry 3- Volume
- Solving Equations 1
- Solving Equations 2
- Ratio & Proportion
- Averages



SOLVING EQUATIONS 2

This workbook contains five skill-building practice sections. Solutions can be found at the end of the workbook.

Practice Section A

Solve each of the following equations for the variable 'x'. Express each answer to 2 decimal places if decimals are given in the question. Otherwise, leave your answer in the form of a fraction.

1. $2x + 3.5 = 0.5 + 9$ = _____

2. $0.3x = 10$ = _____

3. $2x = 0.39x + 1$ = _____

4. $0.75 + 3x = 3(2x + 1) - 4$ = _____

5. $2x + 3(2x + 4) = 9 + 3\frac{7}{8} \div \frac{1}{3}$ = _____

6. $1\frac{1}{2}x + 3\frac{7}{8}\left(2x + \frac{1}{2}\right) = 6$ = _____

7. $2\frac{3}{4}\left(1\frac{5}{8} + 2.5x\right) = 2 - (x + 3)$ = _____

8. $\frac{x}{3} + 3 = 11$ = _____

9. $\frac{3x}{5} - 2 = 5$ = _____

10. $7 + 2x = \frac{x}{3} + 2x$ = _____

11. $3x - \frac{13}{16} = \frac{x}{8} + 2$ = _____



12. $\frac{3x}{2} - 5 = \frac{2}{3} + \frac{x}{4}$ = _____

13. $\frac{x}{3} - 2 = \frac{3}{2}(x - 2)$ = _____

14. $\frac{7x}{8} - 2x + 3 = \frac{x}{3} + 5x - 2\frac{1}{4}$ = _____

15. $16 = 3 + \frac{x}{4} - \frac{5x}{8} + 5\left(3x + \frac{7}{8}\right)$ = _____

Practice Section B

Solve each of the following equations for the variable 'x'. Express each answer as a fraction when necessary.

1. $x - 7(2 - 3x) - 7x = \frac{x}{2} + 4$ = _____

2. $2x = \frac{5}{2}(2x - 3) + \frac{3x}{4}$ = _____

3. $7 - \frac{2}{x} = 5$ = _____

4. $3 + \frac{5}{x} + 10 = 18$ = _____

5. $4 = 12 - \frac{6}{x}$ = _____

6. $\frac{5}{x} - 4 = \frac{7}{4} + \frac{1}{x}$ = _____

7. $3 + \frac{(x-2)}{x} = \frac{3}{x} + 6$ = _____



$$8. \quad \frac{7x}{3} + \frac{3}{4} = 4\frac{1}{2}x \quad = \underline{\hspace{4cm}}$$

$$9. \quad 5(1+3x) - \frac{1}{2}\left(4x - \frac{3}{4}\right) = 3 \quad = \underline{\hspace{4cm}}$$

$$10. \quad \frac{3x}{2} + 2\frac{(x-1)}{4} = 15 - 3(5-x) = \underline{\hspace{4cm}}$$

Practice Section C

Solve each of the following equations for the variable 'x'. Express each answer as a fraction when necessary.

$$1. \quad 3 + x - 2(1-x) + 5(2x+4) - 15 = 0 \quad = \underline{\hspace{4cm}}$$

$$2. \quad \frac{7}{4} - 2\frac{1}{2}\left(1\frac{3}{8} - \frac{1}{2}x\right) = x - 3 + \frac{1}{4}(4x+1) \quad = \underline{\hspace{4cm}}$$

$$3. \quad 7 + 3x \div \frac{1}{2} + x - 2(3-2x) + 3\frac{1}{4}(x+1) = 1 \quad = \underline{\hspace{4cm}}$$

$$4. \quad 4x + \frac{3(x-1)}{2} + x - \frac{2(x+3)}{5} = 6x \quad = \underline{\hspace{4cm}}$$

$$5. \quad 4 + 2(x+1) - \frac{x}{2} + 20\% \times 20 = 3(1-x) + 2 \quad = \underline{\hspace{4cm}}$$

**Practice Section D**

In this section, solutions for the practice questions contain commonly-made errors. For each question, circle the error(s) and give a correct solution.

1. Solve the following equation for the variable 'x'.

$$\frac{x}{2} - \frac{5}{4} = 3 + \frac{3}{8}x$$

Solution:

$$\frac{x}{2} - \frac{5}{4} = 3 + \frac{3}{8}x$$

$$\frac{(x-5)}{8} = \frac{6x}{8}$$

$$x - 5 = 6x$$

$$-5 = 5x$$

$$-1 = x$$

Practice Section E

Challenge Question. If you can do this one, then you get an A⁺. ☺

If $2x + 3 = y$, $7 - 3x = z$, and $z = 4$, find the value of x and y .

= _____



SOLUTIONS

Set W

Solving Equations 2

**SOLVING EQUATIONS 2****Practice Section A**

1. Solution:
 $2x + 3.5 = 0.5 + 9$
 $2x + 3.5 = 9.5$
 $2x = 6$
 $x = 3$

2. Solution:
 $0.3x = 10$
 $x = \frac{10}{0.3}$
 $x = 33.\bar{3}$
 $x = 33.33$

3. Solution:
 $2x = 0.39x + 1$
 $1.61x = 1$
 $x = \frac{1}{1.61}$
 $x = 0.6211$
 $x = 0.62$

4. Solution:
 $0.75 + 3x = 3(2x + 1) - 4$
 $0.75 + 3x = 6x + 3 - 4$
 $0.75 + 3x = 6x - 1$
 $1.75 + 3x = 6x$
 $1.75 = 3x$
 $\frac{1.75}{3} = x$
 $0.58\bar{3} = x$
 $0.58 = x$



5. Solution:

$$2x + 3(2x + 4) = 9 + 3\frac{7}{8} \div \frac{1}{3}$$

$$2x + 6x + 12 = 9 + \frac{31}{8} \times \frac{3}{1}$$

$$8x + 12 = 9 + \frac{93}{8}$$

$$8x + 12 = 9\left(\frac{8}{8}\right) + \frac{93}{8}$$

$$8x + 12 = \frac{72 + 93}{8}$$

$$8x + 12 = \frac{165}{8}$$

$$8x = \frac{165}{8} - 12\left(\frac{8}{8}\right)$$

$$8x = \frac{165 - 96}{8}$$

$$8x = \frac{69}{8}$$

$$x = \frac{69}{8} \div 8$$

$$x = \frac{69}{8} \times \frac{1}{8}$$

$$x = \frac{69}{64}$$

6. Solution:

$$1\frac{1}{2}x + 3\frac{7}{8}\left(2x + \frac{1}{2}\right) = 6$$

$$\frac{3}{2}x + \frac{31}{8}\left(2x + \frac{1}{2}\right) = 6$$

$$(4)\cancel{(8)}\frac{3}{2}x + \cancel{(8)}\frac{31}{8}\left(2x + \frac{1}{2}\right) = (8)6$$

$$12x + 31\left(2x + \frac{1}{2}\right) = 48$$

$$12x + 62x + \frac{31}{2} = 48$$

$$74x = 48 - \frac{31}{2}$$

$$74x = 48\left(\frac{2}{2}\right) - \frac{31}{2}$$

$$74x = \frac{96 - 31}{2}$$

$$74x = \frac{65}{2}$$

$$x = \frac{65}{2} \div 74$$

$$x = \frac{65}{2} \times \frac{1}{74}$$

$$x = \frac{65}{148}$$



7. Solution:

$$2\frac{3}{4}\left(1\frac{5}{8} + 2.5x\right) = 2 - (x + 3)$$

$$\frac{11}{4}\left(\frac{13}{8} + 2.5x\right) = 2 - x - 3$$

$$2.75(1.625 + 2.5x) = -x - 1$$

$$4.46875 + 6.875x = -x - 1$$

$$4.46875 + 7.875x = -1$$

$$7.875x = -5.46875$$

$$x = \frac{-5.46875}{7.875}$$

$$x = -0.69\bar{4}$$

$$x = -0.69$$

8. Solution:

$$\frac{x}{3} + 3 = 11$$

$$\cancel{(3)}\frac{x}{\cancel{3}} + (3)3 = (3)11$$

$$x + 9 = 33$$

$$x = 24$$

9. Solution:

$$\frac{3x}{5} - 2 = 5$$

$$\cancel{(5)}\frac{3x}{\cancel{5}} - (5)2 = (5)5$$

$$3x - 10 = 25$$

$$3x = 35$$

$$x = \frac{35}{3}$$

10. Solution:

$$7 + 2x = \frac{x}{3} + 2x$$

$$(3)7 + (3)2x = \cancel{(3)}\frac{x}{\cancel{3}} + (3)2x$$

$$21 + 6x = x + 6x$$

$$21 + 6x = 7x$$

$$21 = x$$

11. Solution:

$$3x - \frac{13}{16} = \frac{x}{8} + 2$$

$$(16)3x - \cancel{(16)}\frac{13}{\cancel{16}} = 2\cancel{(16)}\frac{x}{\cancel{8}} + (16)2$$

$$48x - 13 = 2x + 32$$

$$46x = 45$$

$$x = \frac{45}{46}$$

12. Solution:

$$\frac{3x}{2} - 5 = \frac{2}{3} + \frac{x}{4}$$

$$2\cancel{(4)}\frac{3x}{\cancel{2}} - (4)5 = (4)\frac{2}{3} + \cancel{(4)}\frac{x}{\cancel{4}}$$

$$6x - 20 = \frac{8}{3} + x$$

$$(3)6x - (3)20 = \cancel{(3)}\frac{8}{\cancel{3}} + (3)x$$

$$18x - 60 = 8 + 3x$$

$$15x = 68$$

$$x = \frac{68}{15}$$



13. Solution:

$$\frac{x}{3} - 2 = \frac{3}{2}(x - 2)$$

$$2(\cancel{6})\frac{x}{\cancel{3}} - (6)2 = 3(\cancel{6})\frac{3}{\cancel{2}}(x - 2)$$

$$2x - 12 = 9(x - 2)$$

$$2x - 12 = 9x - 18$$

$$2x + 6 = 9x$$

$$6 = 7x$$

$$\frac{6}{7} = x$$

14. Solution:

$$\frac{7x}{8} - 2x + 3 = \frac{x}{3} + 5x - 2\frac{1}{4}$$

$$3(\cancel{24})\frac{7x}{\cancel{8}} - (24)2x + (24)3 = 8(\cancel{24})\frac{x}{\cancel{3}} + (24)5x - 6(\cancel{24})\frac{9}{\cancel{4}}$$

$$21x - 48x + 72 = 8x + 120x - 54$$

$$72 + 54 = 8x + 120x + 48x - 21x$$

$$126 = 155x$$

$$x = \frac{126}{155}$$

15. Solution:

$$16 = 3 + \frac{x}{4} - \frac{5x}{8} + 5\left(3x + \frac{7}{8}\right)$$

$$(8)16 = (8)3 + 2(\cancel{8})\frac{x}{\cancel{4}} - (\cancel{8})\frac{5x}{\cancel{8}} + (8)5\left(3x + \frac{7}{8}\right)$$

$$128 = 24 + 2x - 5x + 40\left(3x + \frac{7}{8}\right)$$

$$128 = 24 - 3x + 120x + 5(\cancel{40})\frac{7}{\cancel{8}}$$

$$128 = 24 + 117x + 35$$

$$128 - 24 - 35 = 117x$$

$$69 = 117x$$

$$\frac{69}{117} = x$$

**Practice Section B****1.** Solution:

$$x - 7(2 - 3x) - 7x = \frac{x}{2} + 4$$

$$(2)x - (2)7(2 - 3x) - (2)7x = \cancel{(2)}\frac{x}{\cancel{2}} + (2)4$$

$$2x - 14(2 - 3x) - 14x = x + 8$$

$$2x - 28 + 42x - 14x = x + 8$$

$$30x - 28 = x + 8$$

$$29x = 36$$

$$x = \frac{36}{29}$$

2. Solution:

$$2x = \frac{5}{2}(2x - 3) + \frac{3x}{4}$$

$$(4)2x = 2\cancel{(4)}\frac{5}{\cancel{2}}(2x - 3) + \cancel{(4)}\frac{3x}{\cancel{4}}$$

$$8x = 10(2x - 3) + 3x$$

$$8x = 20x - 30 + 3x$$

$$30 = 15x$$

$$2 = x$$

3. Solution:

$$7 - \frac{2}{x} = 5$$

$$(x)7 - \cancel{(x)}\frac{2}{\cancel{x}} = (x)5$$

$$7x - 2 = 5x$$

$$7x = 5x + 2$$

$$2x = 2$$

$$x = 1$$

4. Solution:

$$3 + \frac{5}{x} + 10 = 18$$

$$(x)3 + \cancel{(x)}\frac{5}{\cancel{x}} + (x)10 = (x)18$$

$$3x + 5 + 10x = 18x$$

$$13x + 5 = 18x$$

$$5 = 5x$$

$$1 = x$$

5. Solution:

$$4 = 12 - \frac{6}{x}$$

$$(x)4 = (x)12 - \cancel{(x)}\frac{6}{\cancel{x}}$$

$$4x = 12x - 6$$

$$4x + 6 = 12x$$

$$6 = 8x$$

$$x = \frac{6}{8}$$

6. Solution:

$$\frac{5}{x} - 4 = \frac{7}{4} + \frac{1}{x}$$

$$(4\cancel{x})\frac{5}{\cancel{x}} - (4x)4 = (\cancel{4x})\frac{7}{\cancel{4}} + (4\cancel{x})\frac{1}{\cancel{x}}$$

$$20 - 16x = 7x + 4$$

$$20 - 4 = 7x + 16x$$

$$16 = 23x$$

$$\frac{16}{23} = x$$



7. Solution:

$$3 + \frac{(x-2)}{x} = \frac{3}{x} + 6$$

$$(x)3 + \cancel{(x)} \frac{\cancel{(x-2)}}{\cancel{x}} = \cancel{(x)} \frac{3}{\cancel{x}} + (x)6$$

$$3x + x - 2 = 3 + 6x$$

$$4x - 2 = 3 + 6x$$

$$-2 - 3 = 6x - 4x$$

$$-5 = 2x$$

$$-\frac{5}{2} = x$$

8. Solution:

$$\frac{7x}{3} + \frac{3}{4} = 4\frac{1}{2}x$$

$$4\cancel{(12)} \frac{7x}{\cancel{3}} + 3\cancel{(12)} \frac{3}{\cancel{4}} = 6\cancel{(12)} \frac{9}{\cancel{2}}x$$

$$28x + 9 = 54x$$

$$9 = 26x$$

$$\frac{9}{26} = x$$

9. Solution:

$$5(1+3x) - \frac{1}{2}\left(4x - \frac{3}{4}\right) = 3$$

$$(2)5(1+3x) - \cancel{(2)} \frac{1}{\cancel{2}}\left(4x - \frac{3}{4}\right) = (2)3$$

$$10(1+3x) - 4x + \frac{3}{4} = 6$$

$$10 + 30x - 4x + \frac{3}{4} = 6$$

$$26x = 6 - 10 - \frac{3}{4}$$

$$26x = -4 - \frac{3}{4}$$

$$(4)26x = (4)(-4) - \cancel{(4)} \frac{3}{\cancel{4}}$$

$$104x = -16 - 3$$

$$104x = -19$$

$$x = -\frac{19}{104}$$

10. Solution:

$$\frac{3x}{2} + 2\frac{(x-1)}{4} = 15 - 3(5-x)$$

$$2\cancel{(4)} \frac{3x}{\cancel{2}} + \cancel{(4)} 2 \frac{\cancel{(x-1)}}{\cancel{4}} = (4)15 - (4)3(5-x)$$

$$6x + 2(x-1) = 60 - 12(5-x)$$

$$6x + 2x - 2 = 60 - 60 + 12x$$

$$8x - 2 = 12x$$

$$-2 = 4x$$

$$-\frac{2}{4} = x$$

**Practice Section C**

1. Solution:

$$3 + x - 2(1 - x) + 5(2x + 4) - 15 = 0$$

$$3 + x - 2 + 2x + 10x + 20 - 15 = 0$$

$$6 + 13x = 0$$

$$13x = -6$$

$$x = -\frac{6}{13}$$

2. Solution:

$$\frac{7}{4} - 2\frac{1}{2}\left(1\frac{3}{8} - \frac{1}{2}x\right) = x - 3 + \frac{1}{4}(4x + 1)$$

$$\cancel{(4)}\frac{7}{\cancel{4}} - 2\cancel{(4)}\frac{5}{\cancel{2}}\left(\frac{11}{8} - \frac{1}{2}x\right) = (4)x - (4)3 + \cancel{(4)}\frac{1}{\cancel{4}}(4x + 1)$$

$$7 - 10\left(\frac{11}{8} - \frac{1}{2}x\right) = 4x - 12 + 4x + 1$$

$$7 - 5\cancel{(10)}\frac{11}{\cancel{4}\cancel{8}} + 5\cancel{(10)}\frac{1}{\cancel{2}}x = 8x - 11$$

$$7 - \frac{55}{4} + 5x = 8x - 11$$

$$11 + 7 - \frac{55}{4} = 8x - 5x$$

$$(4)18 - \cancel{(4)}\frac{55}{\cancel{4}} = (4)3x$$

$$72 - 55 = 12x$$

$$17 = 12x$$

$$\frac{17}{12} = x$$



3. Solution:

$$7 + 3x \div \frac{1}{2} + x - 2(3 - 2x) + 3\frac{1}{4}(x + 1) = 1$$

$$7 + 6x + x - 6 + 4x + \frac{13}{4}(x + 1) = 1$$

$$1 + 11x + \frac{13}{4}x + \frac{13}{4} = 1$$

$$(4)1 + (4)11x + \cancel{(4)}\frac{13}{\cancel{4}}x + \cancel{(4)}\frac{13}{\cancel{4}} = (4)1$$

$$4 + 44x + 13x + 13 = 4$$

$$17 + 57x = 4$$

$$57x = -13$$

$$x = -\frac{13}{57}$$

4. Solution:

$$4x + \frac{3(x-1)}{2} + x - \frac{2(x+3)}{5} = 6x$$

$$(10)4x + 5\cancel{(10)}\frac{3(x-1)}{\cancel{2}} + (10)x - 2\cancel{(10)}\frac{2(x+3)}{\cancel{5}} = (10)6x$$

$$40x + 15(x-1) + 10x - 4(x+3) = 60x$$

$$40x + 15x - 15 + 10x - 4x - 12 = 60x$$

$$61x - 27 = 60x$$

$$x = 27$$

5. Solution:

$$4 + 2(x+1) - \frac{x}{2} + 20\% \times 20 = 3(1-x) + 2$$

$$4 + 2x + 2 - \frac{x}{2} + 4 = 3 - 3x + 2$$

$$10 + 2x - \frac{x}{2} = 5 - 3x$$

$$(2)10 + (2)2x - \cancel{(2)}\frac{x}{\cancel{2}} = (2)5 - (2)3x$$

$$20 + 4x - x = 10 - 6x$$

$$9x = -10$$

$$x = -\frac{10}{9}$$



Practice Section D

1. Solution:

There are two errors. One error is made in line 2 when combining the fractions. 8 is the correct common denominator, but the fractions were not multiplied correctly to get a denominator of 8. The second error also occurs in line 2 on the right-hand side. $3 + 3x \neq 6x$ because 3 and $3x$ are not like terms.

The correct solution is:

$$\begin{aligned}\frac{x}{2} - \frac{5}{4} &= 3 + \frac{3}{8}x \\ 4 \cancel{(8)} \frac{x}{\cancel{2}} - 2 \cancel{(8)} \frac{5}{\cancel{4}} &= (8)3 + \cancel{(8)} \frac{3}{\cancel{8}}x \\ 4x - 10 &= 24 + 3x \\ 4x - 3x &= 24 + 10 \\ x &= 34\end{aligned}$$

Practice Section E

Solution:

Substituting $z = 4$ into $7 - 3x = z$ gives:

$$7 - 3x = 4$$

$$3 = 3x$$

$$1 = x$$

Substituting $x = 1$ into $2x + 3 = y$ s:

$$2x + 3 = y$$

$$2(1) + 3 = y$$

$$2 + 3 = y$$

$$5 = y$$

Therefore, the value of x is 1 and the value of y is 5.