EDT Workbook – Table of Contents

This workbook is designed to provide the practice to perfect the skills introduced in the Math Help Guide. First, do the Pre-Quiz sections in the Math Help Guide and check your answers in the back. That will help you determine how much review you need from this workbook. Whatever you decide, we recommend that you do the practice test at the end of the workbook.

Chapter 1 – Arithmetic

Fractions

Simplify the following:

1. $\frac{2}{5}+\frac{3}{4}$
2. $\frac{7}{8}+\frac{1}{4}$
3. $\frac{1}{3}+\frac{1}{4}+\frac{1}{5}$
4. $\frac{9}{10}+\frac{10}{9}$
5. $\frac{2}{3}+\frac{1}{7}$
6. $\frac{4}{5}-\frac{1}{6}$
7. $\frac{5}{7}-\frac{2}{3}$
8. $\frac{12}{5}-\frac{7}{3}$
9. $\frac{4}{7}\times\frac{4}{5}$
10. $\frac{2}{3}\times\frac{3}{4}\times\frac{4}{5}\times\frac{5}{6}\times\frac{6}{7}$
11. $\frac{15}{4}\times\frac{16}{9}$
12. $\frac{11}{12}\times\frac{24}{7}$
13. $\frac{1}{2}\div\frac{1}{3}$
14. $2\div\frac{7}{2}$
15. $\frac{1}{5}\div 3$
16. $\frac{3}{4}\div\frac{1}{8}$
17. $\left(\frac{1}{2}+\frac{2}{3}\right)\div\left(\frac{7}{6}-\frac{3}{4}\right)$
18. $\left(\frac{4}{5}-\frac{3}{10}\right)\left(\frac{11}{5}+\frac{4}{15}\right)$
19. $\left(\frac{1}{4}\div\frac{5}{6}\right)+\left(\frac{2}{5}\times\frac{1}{2}\right)$
20. $\left(\frac{4}{5}-\frac{3}{10}\right)-\left(\frac{2}{5}\div\frac{3}{10}\right)$
21. $\left(1\frac{2}{3}-2\frac{1}{6}\times 3\frac{1}{2}\right)$
22. $\left(2\frac{4}{3}\div 1\frac{2}{3}\times\frac{2}{3}\right)$

Decimals

Convert the following fractions to decimals and round to two decimal places:

1. $\frac{1}{2}$
2. $\frac{1}{3}$
3. $\frac{2}{3}$
4. $\frac{1}{4}$
5. $\frac{3}{4}$
6. $\frac{3}{40}$
7. $\frac{2}{5}$
8. $\frac{3}{5}$
9. $\frac{4}{5}$
10. $2\frac{1}{2}$
11. $\frac{6}{5}$
12. $3\frac{3}{4}$
13. $\frac{1}{8}$
14. $\frac{3}{8}$
15. $\frac{5}{8}$
16. $\frac{7}{8}$
17. $\frac{1}{9}$
18. $\frac{2}{90}$
19. $3\frac{3}{8}$
20. $\frac{35}{90}$
21. $4\frac{2}{3}$
22. $\frac{1}{10}$
23. $\frac{1}{20}$
24. $\frac{1}{25}$
25. $\frac{1}{50}$

Percents

1. What is 25% of 100?
2. What is 25% of 50?
3. What is 50% of 25?
4. What is 40% of 80?
5. What is 20% of 70?
6. What is 150% of 30?
7. What is 75% of 200?
8. What is 35% of 90?
9. What is 250% of 75?
10. What is 100% more than 60?
11. What is 50% more than 44?
12. What is 25% more than 50?
13. What is 75% more than 200?
14. What is 60% more than 60?
15. What is 200% more than 33?
16. What is 40% less than 80?
17. What is 25% less than 120?
18. What is 50% less than 72?
19. What is 60% less than 90?
20. What is 75% less than 96?
21. What is 150% of 150% of 100?
22. What is 150% more than 150% of 100?
23. What is 50% less than150% of 100?
24. What is 75% more than 125% of 40?
25. What is 60% of 40% less than 100?
26. What is 25% of 25% of 160?

Chapter 2 – Exponents and Radicals

Exponents

Evaluate the following and express your answer as a whole number or fraction:

1. 2^3
2. 1^{12}
3. 1^{13}
4. $(-1)^{13}$
5. 3^3
6. $\left(\frac{2}{3}\right)^2$
7. $\left(\frac{1}{2}\right)^3$
8. $\left(-\frac{1}{2}\right)^3$

Solve for x in each of the following:

9. $x^2 = 49$
10. $x^3 = 125$
11. $x^2 = 144$
12. $x^2 = 121$
13. $x^3 = 27$
14. $x^{14} = 1$
15. $x^7 = 1$

Simplify each of the following (i.e. do not calculate the answer, just combine the components to form a new term – the first one is done as an example):

16. $3^2 \times 3^3 = 3^5$
17. $2^4 \times 2^7$
18. $6^3 \times 6^2 \times 6^6$
19. $10^2 \times 10^8$
20. $4^7 \div 4^4$
21. $11^8 \div 11^7$
22. $5^5 \div 5^3$
23. $13^6 \div 13^2$
24. $\left(2^5\right)^4$
25. $\left(3^3\right)^5$
26. $\left(10^2\right)^{10}$
27. $\left(11^4\right)^7$

Radicals

Simplify and express the following as a whole number or as a radical in simplest form (i.e. $\sqrt{45} = 3\sqrt{5}$):

1. $\sqrt{100}$
2. $\sqrt{144}$
3. $\sqrt{81}$
4. $\sqrt{25} + \sqrt{64}$
5. $\sqrt{121} - \sqrt{49}$
6. $\sqrt{12} \times \sqrt{15}$
7. $\sqrt{7} \times \sqrt{28}$
8. $\sqrt{8} \times \sqrt{14}$
9. $\sqrt{6} \times \sqrt{54}$
10. $\sqrt{180} \div \sqrt{20}$
11. $\sqrt{160} \div \sqrt{5}$
12. $\sqrt{320} \div \sqrt{8}$
13. $\sqrt{90} \div \sqrt{10}$
14. $\left(\sqrt{36}\right)^2$
15. $\sqrt[3]{64}$
16. $\sqrt[11]{1}$
17. $\left(\sqrt[4]{64}\right)^4$
18. $(49)^{\frac{1}{2}}$
19. $(27)^{\frac{1}{3}}$
20. $(32)^{\frac{1}{5}}$

Chapter 3 – Algebra

Solve for the variable in each of the following:

1. $4x - 20 = 40$
2. $3y + 15 = 21$
3. $7y - 12 = -3y + 18$
4. $4x + 10 = 6x + 30$
5. $8z + 13 = 52 + 5z$
6. $7z - 5 = 25 - 8z$
7. $-10x - 50 = -5x + 25$
8. $2(10x) + 3(5) = 3(5x) + 5(20)$
9. $-3(5y) - 7(4) = -4(4y) - 5(5)$
10. $2(2y + 3y + 4y) = 6(5 + 6 + 7)$

Isolate x in each of the following:

11. $4x + 9y = 12$
12. $6z + 3x = 18$
13. $5x - 6y = 3x + 2y - 16$
14. $\dfrac{12z + 18y}{4x} = 3$
15. $\dfrac{10x}{4y} = 15$
16. $\dfrac{126y}{7x} = 9$
17. $2z + 3y + 4x = 12$
18. $3xy = 15$
19. $5xy = 10x + 4y + 20$
20. $7x + 14xy = 14 + 28y$

Solve each of the following systems of equations for all of the variables involved:

21. $2x + 3y = 8$ and $2x - 6y = -10$

22. $5x - 4y = 20$ and $3x + 4y = 28$

23. $x = 5y - 20$ and $2x - 6y = 20$

24. $2y = 12x + 24$ and $5x - 2y = -94$

25. $3x + 3y = 10$ and $x + 2y = 4$

26. $4m - 3n = 37$ and $8m + 7n = 35$

27. $6p - 5q = -22$ and $4q - 12p = 14$

28. $7s + 3q = 68$ and $3s - 9q = 60$

Solve each of the following for all possible values of x:

29. $x^2 - 25 = 0$

30. $x^2 - 6x + 5 = 0$

31. $x^2 + 11x - 26 = 0$

32. $x^2 + 6x + 9 = 0$

33. $x^2 - 7x + 10 = 0$

34. $x^2 = 12x + 45$

35. $x^2 - 10x = -21$

36. $2x^2 + 14x - 60 = 0$

37. $3x^2 - 9x + 6 = 0$

38. $30 = 5x^2 - 25x$

Expand each of the following expressions:

39. $(x+4)(x-11)$

40. $(x-3)(x+2)$

41. $(5-y)(5+y)$

42. $(y-10)(y+11)$

43. $(2z+4)(5+z)$

44. $(7+z)(z^2-4)$

45. $(5s+2)(3s-5)$

46. $(6x+2)\left(x-\frac{1}{2}\right)$

47. $\left(\sqrt{2}-\sqrt{5}\right)\left(\sqrt{2}+\sqrt{5}\right)$

48. $\left(\sqrt{x}-2\right)\left(\sqrt{x}+2\right)(x+4)$

Solve the following inequalities:

49. $x+3>5$

50. $-4x-6<6$

51. $3x+2\geq 5x+4$

Solve the following absolute value equations:

52. $|2x - 1| = 3x - 4$

53. $|x + 5| - 2x = 3x + 1$

Solve the following word problems:

54. The local food bank raised one million pounds of food from three sources during its recent food drive. Find how much food each source contributed if:
    - local businesses raise 100,000 pounds more than schools
    - schools raised half the total of the grocery stores and local businesses combined

55. Becca is twice as old as Susan and Greg is 9 years older than Susan. 3 years ago, Becca was 9 less than 3 times Susan's age. How old is Greg now?

For the following questions, determine if the function is: (a) always positive; (b) always negative; or (c)sometimes positive and sometimes negative depending on the value of x.

56. $f(x) = x^2 - 3x - 4$

57. $f(x) = x^2 + 3x + 4$

58. $f(x) = -x^2 - 3x + 4$

Chapter 4 – Co-ordinate Geometry

Solve for the slope, x-intercept and y-intercept of each of the following lines:

1. $y = 5x - 7$
2. $-y = 3x + 5$
3. $2y = 7x - 12$
4. $3x = y - 10$
5. $x = \frac{1}{2}y + 4$
6. $y - 2x = 11$
7. $4x - 2y = 8$
8. $\frac{1}{3}y = x + 5$
9. $3(x + 2y) - 12 = 0$
10. $\frac{1}{2}(y - 4x) = 3$

Find the equation of the line;

11. with a slope of 4 that passes through (2, 5).

12. with a slope of $\frac{1}{2}$ that passes through (0, 0).

13. with a slope of -2 that passes through (2, 0).

14. with a slope of 6 that passes through (-3, 4).

15. with a slope of -3 that passes through (-2, 2).

16. that passes through (1, 4) and (3, 8).

17. that passes through (-1, -1) and (3,1).

18. that passes through (4, 2) and (8, 2).

19. that passes through (5, 3) and (1, -1).

20. that passes through (-2, 2) and (6, 4).

Find the distance between the following pairs of points:

21. (1, 4) and (4, 8)

22. (–2, 2) and (10, 7)

23. (9, 3) and (3, –5)

24. (4, –4) and (1, –1)

25. (7, 14) and (–17, 7)

Graph the following functions:

26. $y = 2x + 1$

27. $y = -x + 2$

28. $y = -\frac{1}{2}x - 3$

29. $2x - 3y = -12$

30. $x = 2y - 8$

31. $y = x^2 + 4$

32. $y = 2 - 2x^2$

33. $y = x^2 + 3x + 4$

Chapter 5 – Sequences and Summations

Sequences

1. If S is the sequence of numbers defined by the equation $S_{n+1} = 3S_n + 2$ and $S_1 = 5$, what is the value of:

   (a) S_2?

   (b) S_3?

   (c) S_4?

2. If P is the sequence of numbers defined by the equation $P_n = P_{n-1} - 2$ and $P_2 = 8$, what is the value of:

   (a) P_3?

   (b) P_4?

   (c) P_5?

3. If R is the sequence of numbers defined by the equation $R_{n+1} = 2R_n - 5$ and $R_4 = 13$, what is the value of:

   (a) R_3?

   (b) R_2?

   (c) R_1?

4. If S is the sequence of numbers defined by the equation $S_{n+1} = (S_n)^2 + S_n$ and $S_1 = 3$, what is the value of:

   (a) S_2?

   (b) S_3?

   (c) S_4?

5. If P is the sequence of numbers defined by the equation $P_{n+1} = 4P_n + 3$ and $P_4 = 191$, what is the value of:

   (a) P_3?

   (b) P_2?

   (c) P_1?

Summations

6. The set Q is generated by the rule $Q_{n+1} = 2Q_n - 4$ for $1 \le n \le 4$.

   If $Q_1 = 6$ what is the summation of set Q?

7. The set U is generated by the rule $U_{n+1} = (U_n)^2 - 5$ for $1 \le n \le 4$.

   If $U_1 = 3$ what is the summation of set U?

8. The set Z is generated by the rule $Z_{n+1} = \frac{1}{2}Z_n + 8$ for $2 \le n \le 4$.

   If $Z_2 = 4$ what is the summation of set Z?

9. Given $\sum_{n=3}^{6} n^2 - 2n + 5$, write out the expression and evaluate it.

10. Given $\sum_{n=1}^{4} 4n^2 + 7$, write out the expression and evaluate it.

11. Given $\sum_{n=2}^{4} n^2 + 3n - 9$, write out the expression and evaluate it.

12. Given $\sum_{n=1}^{5} 3n + 1$, write out the expression and evaluate it.

Chapter 6 – Logarithms

Solve for x in each of the following:

1. $\log_5 125 = x$

2. $\log_5 25 = x$

3. $\log_3 81 = x$

4. $\log_4 16 = x$

5. $\log_4 2 = x$

6. $\log_6 216 = x$

7. $\log_x 49 = 2$

8. $\log_x 243 = 5$

9. $\log_x 64 = 6$

10. $\log_x 625 = 4$

11. $\log_x 36 = 2$

12. $\log 10 = x$

13. $\log 1000 = x$

14. $\log x = 5$

15. $\log x = 7$

Combine the left side of each equation into one term and then solve for x in each of the following:

16. $\log_2 \frac{1}{2} + \log_2 16 = x$

17. $\log_4 8 + \log_4 8 = x$

18. $\log_{12} 8 + \log_{12} 18 = x$

19. $\log 1000 + \log 100 = x$

20. $\log 25 + \log 40 = x$

21. $\log 12.5 + \log 8 = x$

22. $\log_3 \frac{1}{9} + \log_3 81 = x$

23. $\log_2 64 - \log_2 32 = x$

24. $\log_2 128 - \log_2 16 = x$

25. $\log_4 128 - \log_4 2 = x$

26. $\log_3 108 - \log_3 4 = x$

27. $\log_5 400 - \log_5 16 = x$

28. $\log 100 - \log 10 = x$

29. $\log 5000 - \log 50 = x$

30. $\log 100 - \log 1000 = x$

Chapter 7 – Logic

1. Translate each of the following into an if-then statement:

   (a) All humans are mammals.

   (b) You may apply for your pension if you resign.

   (c) You may run for office if you are a member.

   (d) The bell will sound if the beam is broken.

   (e) Your premium will drop back to its prior category after three accident-free years.

   (f) To apply for the supplement you must pass a means test.

   (g) A positive result on this test means that you are still infected.

Solve the following logic problems:

2. Mike, George, Jim and Ed are jockeys who ride Thunder, Lightning, Tempest and Blizzard, though not respectively. These are the only horses in the final race at Apocalypse Track. Match horse, rider and finishing position from these clues:

    1. Mike finished third.
    2. George rode Lightning.
    3. Blizzard did not finish last.
    4. Lightning finished behind Thunder.
    5. Ed passed Blizzard and Thunder to win.
    6. Jim was to ride Thunder but got switched.

3. A fruit stand carries at least one kind of the following kinds of fruits: figs, kiwis, oranges, pears, tangerines and watermelons. The stand does not carry any other kind of fruit. The selection of fruit the stand carries is consistent with the following conditions:

   If the stand carries kiwis, then it does not carry pears.

   If the stand does not carry tangerines, then it carries kiwis.

   If the stand carries oranges, then it carries both pears and watermelons.

   If the stand carries watermelons, then it carries figs or tangerines or both.

   a. What is a possible combination of fruit with watermelons?

   b. If the stand only had one type of fruit available, what are the possible fruit that would satisfy this condition?

c. Can the fruit stand carry both oranges and tangerines?

d. If the stand had to carry four types of fruit, provide one possible set. Can five types of fruit be present?

4. Automation, the trademark of a modern economy, is essential to maximizing a country's economic production while minimizing its costs. Executives of freight transportation companies want to increase revenues while reducing costs. Consequently, they propose significantly greater automation of freight trucks transporting goods. Yet, this should be rejected. Radical automation of the transportation fleet would cause motorists to lose trust in the transportation system as studies show motorists believe vehicular automation increases risks to road safety.

Which one of the following conclusions can be drawn from the author's argument above?

a. Citizens are generally wary about technological innovation and the disruption that can result.

b. Freight transportation should not be heavily automated.

c. Executives of freight transportation companies are becoming too greedy.

d. Trends in the general economy do not apply to the transportation industry.

e. Due to economic forces, automation of freight transportation is inevitable.

Practice Test

Section 1 – Algebra & Arithmetic

1. Evaluate $\left(\frac{3}{5}-\frac{3}{7}\right)\div\left(\frac{2}{3}\times\frac{6}{7}\right)$.

2. Solve for x and y.

$$2x+3y=13$$
$$x-y=-1$$

3. Find the distance between the points (6, -9) and (-2, -3).

4. Find the equation of the line that passes through the point (3, 5) and is perpendicular to $y=\frac{1}{2}x+2$.

(Note: a perpendicular line is the negative inverse of the original, i.e. $m_2=-\frac{1}{m_1}$)

5. Given $\sum_{n=3}^{6} n^2 - 2n + 1$, evaluate the expression

6. Solve for x: $log_3 2x - log_3 4 = 2$

7. Solve $y^2 - 7y + 12 = 0$

8. A construction company is performing a project with three trades; carpentry, mechanical and electrical. If there is twice the value of mechanical work compared to carpentry work, and the electrical work at seventy-five thousand dollars is twenty-five thousand more than the average of all three individual trades, what is the value of the project?

Section 2 – Graphing & Memo

1. Graph the following function: $y = 2x^2 + 7x + 3$

2. Write a memo outlining any significant information that you can extract from the following tables and support your position. Do not merely describe the date in the tables, but draw conclusions. (Minimum 250 words, maximum 500 words)

Greenhouse gas emissions by province and territory, Canada, 1990, 2005 and 2017

(Megatonnes of carbon dioxide equivalent)

Province or territory	1990	2005	2017
Newfoundland and Labrador (NL)	9.4	9.9	10.5
Prince Edward Island (PE)	1.9	2	1.8
Nova Scotia (NS)	19.6	23.2	15.6
New Brunswick (NB)	16.1	20	14.3
Quebec (QC)	86.1	86.5	78
Ontario (ON)	180	203.9	158.7
Manitoba (MB)	18.3	20.1	21.7
Saskatchewan (SK)	44.4	68	77.9
Alberta (AB)	172.6	231.1	272.8
British Columbia (BC)	51.6	63.1	62.1
Yukon (YT)	0.5	0.5	0.5
Northwest Territories (NT)	1.6 [a]	1.6	1.3
Nunavut (NU)	n/a	0.4	0.6

Note: [a] 1990 emissions data for the Northwest Territories include emissions for Nunavut, which was part of the Northwest Territories until 1999. n/a = not applicable. Data are presented as rounded figures. However, all calculations have been performed using unrounded data. Emission levels for some years have been revised in light of improvements to estimation methods and availability of new data.

Source: Environment and Climate Change Canada (2019) National Inventory Report 1990-2017: Greenhouse Gas Sources and Sinks in Canada (www.canada.ca/en/environment-climate-change/services/climate-change/greenhouse-gas-emissions/inventory.html).

Available on the Environmental indicators website (www.canada.ca/environmental-indicators).

Gross Domestic Product for Canada, Provinces and Territories, 2000 to 2018

(Millions of 2012 CDN Dollars)

Province or territory	2000	2005	2010	2015	2018
Newfoundland and Labrador	21,946	28,186	30,474	30,806	30,758
Prince Edward Island	4,191	4,691	4,948	5,281	5,700
Nova Scotia	29,572	32,762	34,697	35,013	36,518
New Brunswick	25,058	28,281	29,404	29,276	30,295
Quebec	270,025	297,892	317,802	341,688	365,614
Ontario	527,438	596,629	609,770	677,384	728,364
Manitoba	42,734	47,128	52,842	59,083	62,732
Saskatchewan	58,198	64,170	68,913	79,574	82,503
Alberta	207,780	248,615	272,172	326,477	335,096
British Columbia	154,966	180,855	195,819	224,153	246,506
Yukon	1,536	1,686	2,254	2,320	2,626
Northwest Territories	3,484	5,180	4,707	4,621	4,955
Nunavut	1,280	1,455	2,004	2,353	2,955

Notes:
1. Source: Statistics Canada Data Table: 36-10-0402-01; Canada data is from 36-10-0434-01
2. Prepared by: NWT Bureau of Statistics

Section 3 – Logic

1. Solve the following logic problem:

Alan, Bob, Cyril and Dan are married to Edna, Faye, Gina, and Helen, though not respectively. The four couples live on First Street in houses numbered 2, 4, 6, 8 running from south, 2, to north, 8. These are the only houses on the street. Identify the couples and their houses from the following clues:

(a) Bob lives in no. 4

(b) Dan is Gina's brother, and this is the only blood relationship among the eight.

(c) Cyril and Dan are brothers-in-law.

(d) Cyril has neighbors on each side.

(e) Bob lives south of Helen.

(f) Edna and Gina are sisters-in-law.

2. Evaluate the reasoning in the following statement. It is possible that more than one choice will appear to be a possible answer. You are to choose the ***best*** answer and ***explain*** your rationale.

The strength of a suspension bridge is partially dependent on how deep the supports are anchored into the ground. When the first suspension bridges were built, best-practices dictated that the supports be anchored into the ground such that half of the total height was below ground. During the inspection of an aging suspension bridge, officials noted that updated engineering practice and theory suggested that the bridge's supports be reinforced to meet anticipated increase in use.

Which one of the following conclusions can be drawn from the above?

a. In light of current engineering theory, the bridge should be closed until reinforced.

b. Even if reinforced, the bridge will still not be safe.

c. The original best-practices for the depth of the supports failed to anticipate future changes in demand or engineering theory.

d. In light of the officials' findings, every aging suspension bridge must be updated to provide additional strength and carrying capacity.

e. The reinforcement based on current theory should not be completed since there is no evidence to guarantee that they will be adequate based on future research.

Solutions

Chapter 1 – Arithmetic

Fractions

1. $\frac{2}{5}+\frac{3}{4}$

$=\frac{8+15}{20}=\frac{23}{20}$

2. $\frac{7}{8}+\frac{1}{4}$

$=\frac{7+2}{8}=\frac{9}{8}$

3. $\frac{1}{3}+\frac{1}{4}+\frac{1}{5}$

$=\frac{20+15+12}{60}=\frac{47}{60}$

4. $\frac{9}{10}+\frac{10}{9}$

$=\frac{81+100}{90}=\frac{181}{90}$

5. $\frac{2}{3}+\frac{1}{7}$

$=\frac{14+3}{21}=\frac{17}{21}$

6. $\frac{4}{5}-\frac{1}{6}$

$=\frac{24-5}{30}=\frac{19}{30}$

7. $\frac{5}{7}-\frac{2}{3}$

$=\frac{15-14}{21}=\frac{1}{21}$

8. $\frac{12}{5}-\frac{7}{3}$

$=\frac{36-35}{15}=\frac{1}{15}$

9. $\frac{4}{7}\times\frac{4}{5}$

$=\frac{16}{35}$

10. $\frac{2}{3}\times\frac{3}{4}\times\frac{4}{5}\times\frac{5}{6}\times\frac{6}{7}$

$=\frac{2}{7}$

11. $\frac{15}{4}\times\frac{16}{9}$

$=\frac{20}{3}$

12. $\frac{11}{12}\times\frac{24}{7}$

$=\frac{22}{7}$

13. $\frac{1}{2}\div\frac{1}{3}$

$=\frac{1}{2}\times\frac{3}{1}=\frac{3}{2}$

14. $2\div\frac{7}{2}$

$=2\times\frac{2}{7}=\frac{4}{7}$

15. $\frac{1}{5}\div 3$

$=\frac{1}{5}\times\frac{1}{3}=\frac{1}{15}$

16. $\frac{3}{4}\div\frac{1}{8}$

$=\frac{3}{4}\times\frac{8}{1}=6$

17. $\left(\frac{1}{2}+\frac{2}{3}\right)\div\left(\frac{7}{6}-\frac{3}{4}\right)$

$=\left(\frac{3+4}{6}\right)\div\left(\frac{14-9}{12}\right)$

$=\left(\frac{7}{6}\right)\times\left(\frac{12}{5}\right)=\frac{14}{5}$

18. $\left(\frac{4}{5}-\frac{3}{10}\right)\left(\frac{11}{5}+\frac{4}{15}\right)$

$=\left(\frac{8-3}{10}\right)\times\left(\frac{33+4}{15}\right)$

$=\left(\frac{5}{10}\right)\times\left(\frac{37}{15}\right)=\frac{37}{30}$

19. $\left(\frac{1}{4}\div\frac{5}{6}\right)+\left(\frac{2}{5}\times\frac{1}{2}\right)$

$=\left(\frac{1}{4}\times\frac{6}{5}\right)+\left(\frac{2}{10}\right)$

$=\left(\frac{6}{20}\right)+\left(\frac{2}{10}\right)=\frac{1}{2}$

20. $\left(\frac{4}{5}-\frac{3}{10}\right)-\left(\frac{2}{5}\div\frac{3}{10}\right)$

$=\left(\frac{8-3}{10}\right)-\left(\frac{2}{5}\times\frac{10}{3}\right)$

$=\left(\frac{5}{10}\right)-\left(\frac{4}{3}\right)=-\frac{5}{6}$

21. $\left(1\frac{2}{3}-2\frac{1}{6}\times 3\frac{1}{2}\right)$

$=\left(\frac{5}{3}-\frac{13}{6}\times\frac{7}{2}\right)$

$=\left(\frac{20}{12}-\frac{91}{12}\right)=-\frac{71}{12}$

22. $\left(2\frac{4}{3}\div 1\frac{2}{3}\times\frac{2}{3}\right)$

$=\left(\frac{10}{3}\div\frac{5}{3}\times\frac{2}{3}\right)$

$=\left(\frac{10}{3}\times\frac{3}{5}\times\frac{2}{3}\right)=\frac{4}{3}$

Decimals

1. $\frac{1}{2} = 0.50$
2. $\frac{1}{3} = 0.33$
3. $\frac{2}{3} = 0.67$
4. $\frac{1}{4} = 0.25$
5. $\frac{3}{4} = 0.75$
6. $\frac{3}{40} = 0.08$
7. $\frac{2}{5} = 0.40$
8. $\frac{3}{5} = 0.60$
9. $\frac{4}{5} = 0.80$
10. $2\frac{1}{2} = 2.50$
11. $\frac{6}{5} = 1.20$
12. $3\frac{3}{4} = 3.75$
13. $\frac{1}{8} = 0.13$
14. $\frac{3}{8} = 0.38$
15. $\frac{5}{8} = 0.63$
16. $\frac{7}{8} = 0.88$
17. $\frac{1}{9} = 0.11$
18. $\frac{2}{90} = 0.02$
19. $3\frac{3}{8} = 3.38$
20. $\frac{35}{90} = 0.39$
21. $4\frac{2}{3} = 4.67$
22. $\frac{1}{10} = 0.10$
23. $\frac{1}{20} = 0.05$
24. $\frac{1}{25} = 0.04$
25. $\frac{1}{50} = 0.02$

Percents

1. $100 \times 0.25 = 25$
2. $50 \times 0.25 = 12.5$
3. $25 \times 0.50 = 12.5$
4. $80 \times 0.40 = 32$
5. $70 \times 0.20 = 14$
6. $30 \times 1.50 = 45$
7. $200 \times 0.75 = 150$
8. $90 \times 0.35 = 31.5$
9. $75 \times 2.50 = 187.5$
10. $60 \times 2.00 = 120$
11. $44 \times 1.50 = 66$
12. $50 \times 1.25 = 62.5$
13. $200 \times 1.75 = 350$
14. $60 \times 1.60 = 96$
15. $33 \times 3.00 = 99$
16. $80 \times 0.60 = 48$
17. $120 \times 0.75 = 90$
18. $72 \times 0.50 = 36$
19. $90 \times 0.40 = 36$
20. $96 \times 0.25 = 24$
21. $100 \times 1.50 \times 1.50 = 225$
22. $100 \times 1.50 \times 2.50 = 375$
23. $100 \times 1.50 \times 0.50 = 75$
24. $40 \times 1.25 \times 1.75 = 87.5$
25. $100 \times 0.60 \times 0.60 = 36$
26. $160 \times 0.25 \times 0.25 = 10$

Chapter 2 – Exponents and Radicals

Exponents

1. 8
2. 1
3. 1
4. –1
5. 27
6. $\frac{4}{9}$
7. $\frac{1}{8}$
8. $-\frac{1}{8}$
9. $x = 7, -7$
10. $x = 5$
11. $x = 12, -12$
12. $x = 11, -11$
13. $x = 3$
14. $x = 1, -1$
15. $x = 1$
16. 3^5
17. 2^{11}
18. 6^{11}
19. 10^{10}
20. 4^3
21. 11
22. 5^2
23. 13^4
24. 2^{20}
25. 3^{15}
26. 10^{20}
27. 11^{28}

Radicals

1. 10
2. 12
3. 9
4. 13
5. 4
6. $\sqrt{12} \times \sqrt{15}$
   $= \sqrt{180} = 6\sqrt{5}$
7. $\sqrt{7} \times \sqrt{28}$
   $= \sqrt{196} = 14$
8. $\sqrt{8} \times \sqrt{14}$
   $= \sqrt{112} = 4\sqrt{7}$
9. $\sqrt{6} \times \sqrt{54}$
   $= \sqrt{324} = 18$
10. $\sqrt{180} \div \sqrt{20}$
    $= \sqrt{9} = 3$
11. $\sqrt{160} \div \sqrt{5}$
    $= \sqrt{32} = 4\sqrt{2}$
12. $\sqrt{320} \div \sqrt{8}$
    $= \sqrt{40} = 2\sqrt{10}$
13. $\sqrt{90} \div \sqrt{10}$
    $= \sqrt{9} = 3$
14. $\left(\sqrt{36}\right)^2$
    $= 36$
15. $\sqrt[3]{64}$
    $= 4$
16. $\sqrt[11]{1}$
    $= 1$
17. $\left(\sqrt[4]{64}\right)^4$
    $= 64$
18. $(49)^{\frac{1}{2}}$
    $= \sqrt{49} = 7$
19. $(27)^{\frac{1}{3}}$
    $= \sqrt[3]{27} = 3$
20. $(32)^{\frac{1}{5}}$
    $= \sqrt[5]{32} = 2$

Chapter 3 – Algebra

1. $4x = 40 + 20$

   $4x = 60$

   $x = 15$

2. $3y = 21 - 15$

   $3y = 6$

   $y = 2$

3. $7y + 3y = 18 + 12$

   $10y = 30$

   $y = 3$

4. $4x - 6x = 30 - 10$

   $-2x = 20$

   $x = -10$

5. $8z - 5z = 52 - 13$

   $3z = 39$

   $z = 13$

6. $7z + 8z = 25 + 5$

   $15z = 30$

   $z = 2$

7. $-10x + 5x = 25 + 50$

   $-5x = 75$

   $x = -15$

8. $20x + 15 = 15x + 100$

   $5x = 85$

   $x = 17$

9. $-15y - 28 = -16y - 25$

   $-15y + 16y = -25 + 28$

   $y = 3$

10. $2(9y) = 6(18)$

    $18y = 108$

    $y = 6$

11. $4x + 9y = 12$

    $4x = 12 - 9y$

    $x = 3 - \frac{9}{4}y$

12. $6z + 3x = 18$

    $3x = 18 - 6z$

    $x = 6 - 2z$

13. $5x - 6y = 3x + 2y - 16$

    $2x = 2y + 6y - 16$

    $x = 4y - 8$

14. $\frac{12z + 18y}{4x} = 3$

    $12z + 18y = 12x$

    $x = z + \frac{3}{2}y$

15. $\frac{10x}{4y} = 15$

    $10x = 60y$

    $x = 6y$

16. $\frac{126y}{7x} = 9$

    $126y = 63x$

    $x = 2y$

17. $2z + 3y + 4x = 12$

$$4x = 12 - 2z - 3y$$

$$x = 3 - \tfrac{1}{2}z - \tfrac{3}{4}y$$

18. $3xy = 15$

$$x = \frac{5}{y}$$

19. $5xy = 10x + 4y + 20$

$$5xy - 10x = 4y + 20$$

$$x(5y - 10) = 4y + 20$$

$$x = \frac{4y + 20}{5y - 10}$$

20. $7x + 14xy = 14 + 28y$

$$x(7 + 14y) = 2(7 + 14y)$$

$$x = 2$$

21. $2x + 3y = 8$

$2x - 6y = -10$

$$9y = 18$$

$$y = 2$$

$$x = 1$$

22. $5x - 4y = 20$

$3x + 4y = 28$

$$8x = 48$$

$$x = 6$$

$$y = \tfrac{5}{2}$$

23. $2x - 10y = -40 \leftarrow (x - 5y = -20) \times 2$

$2x - 6y = 20$

$$-4y = -60$$

$$y = 15$$

$$x = 55$$

24. $-12x + 2y = 24$

$5x - 2y = -94$

$$-7x = -70$$

$$x = 10$$

$$y = 72$$

25. $3x + 3y = 10$

$3x + 6y = 12 \leftarrow (x + 2y = 4) \times 3$

$$-3y = -2$$

$$y = \tfrac{2}{3}$$

$$x = \tfrac{8}{3}$$

26. $8m - 6n = 74 \leftarrow (4m - 3n = 37) \times 2$

$8m + 7n = 35$

$$-13n = 39$$

$$n = -3$$

$$m = 7$$

27. $-10q + 12p = -44 \leftarrow (6p - 5q = -22) \times 2$

$$\underline{4q - 12p = 14}$$

$$-6q = -30$$

$$q = 5$$

$$p = \tfrac{1}{2}$$

28. $21s + 9q = 204 \leftarrow (7s + 3q = 68) \times 3$

$$\underline{3s - 9q = 60}$$

$$24s = 264$$

$$s = 11$$

$$q = -3$$

29. $x^2 - 25 = 0$

$$x^2 = 25$$

$$x = -5, 5$$

30. $x^2 - 6x + 5 = 0$

$$(x-1)(x-5) = 0$$

$$x = 1, 5$$

31. $x^2 + 11x - 26 = 0$

$$(x-2)(x+13) = 0$$

$$x = -13, 2$$

32. $x^2 + 6x + 9 = 0$

$$(x+3)^2 = 0$$

$$x = -3$$

33. $x^2 - 7x + 10 = 0$

$$(x-2)(x-5) = 0$$

$$x = 2, 5$$

34. $x^2 = 12x + 45$

$$(x+3)(x-15) = 0$$

$$x = -3, 15$$

35. $x^2 - 10x = -21$

$$(x-3)(x-7) = 0$$

$$x = 3, 7$$

36. $2x^2 + 14x - 60 = 0$

$$(x-3)(x+10) = 0$$

$$x = -10, 3$$

37. $3x^2 - 9x + 6 = 0$

$$(x-2)(x-1) = 0$$

$$x = 2, 1$$

38. $30 = 5x^2 - 25x$

$$(x-6)(x+1) = 0$$

$$x = -1, 6$$

39. $(x+4)(x-11)$

$$= x^2 + 4x - 11x - 44$$

$$= x^2 - 7x - 44$$

40. $(x-3)(x+2)$

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

$$= x^2 - x - 6$$

41. $(5-y)(5+y)$

$$= 25 - 5y + 5y - y^2$$

$$= 25 - y^2$$

42. $(y-10)(y+11)$

$$= y^2 - 10y + 11y - 110$$

$$= y^2 + y - 110$$

43. $(2z+4)(5+z)$

$= 10z + 20 + 2z^2 + 4z$

$= 2z^2 + 14z + 20$

44. $(7+z)(z^2-4)$

$= 7z^2 + z^3 - 28 - 4z$

$= z^3 + 7z^2 - 4z - 28$

45. $(5s+2)(3s-5)$

$= 15s^2 + 6s - 25s - 10$

$= 15s^2 - 19s - 10$

46. $(6x+2)\left(x-\frac{1}{2}\right)$

$= 6x^2 - 3x + 2x - 1$

$= 6x^2 - x - 1$

47. $(\sqrt{2}-\sqrt{5})(\sqrt{2}+\sqrt{5})$

$= 2 - \sqrt{10} + \sqrt{10} - 5$

$= -3$

48. $(\sqrt{x}-2)(\sqrt{x}+2)(x+4)$

$= (x - 2\sqrt{x} + 2\sqrt{x} - 4)(x+4)$

$= (x-4)(x+4) = x^2 - 16$

49. $x + 3 > 5$

$x > 5 - 3$

$x > 2$

50. $-4x - 6 < 6$

$-4x < 12$

$x > -3$

51. $3x + 2 \geq 5x + 4$

$3x - 5x \geq 4 - 2$

$-2x \geq 2$

$x \leq -1$

52. $2x - 1 = 3x - 4$

$2x - 3x = 1 - 4$

$-x = -3$

$x = 3$

$2x - 1 = -(3x - 4)$

$2x - 1 = -3x + 4$

$2x + 3x = 1 + 4$

$5x = 5$

$x = 1$

53. $x + 5 = 5x + 1$

$-4x = -4$

$x = 1$

$x + 5 = -(5x + 1)$

$x + 5 = -5x - 1$

$6x = -6$

$x = -1$

54. Businesses raised 433,333 pounds of food; schools raised 333,333 pounds of food; and grocery stores raised 233,334 pounds of food.

55. Greg is 24 years old.

56. (c) sometimes positive and sometimes negative

57. (a) always positive

58. (c) sometimes positive and sometimes negative

Chapter 4 – Co-ordinate Geometry

1. $y = 5x - 7$

$y_{\text{int}} = -7,\ m = 5$

$y = 0 \rightarrow x_{\text{int}} = \frac{7}{5}$

2. $-y = 3x + 5$

$y = -3x - 5$

$y_{\text{int}} = -5,\ m = -3$

$y = 0 \rightarrow x_{\text{int}} = -\frac{5}{3}$

3. $2y = 7x - 12$

$y = \frac{7}{2}x - 6$

$y_{\text{int}} = -6,\ m = \frac{7}{2}$

$y = 0 \rightarrow x_{\text{int}} = \frac{12}{7}$

4. $3x = y - 10$

$y = 3x + 10$

$y_{\text{int}} = 10,\ m = 3$

$y = 0 \rightarrow x_{\text{int}} = -\frac{10}{3}$

5. $x = \frac{1}{2}y + 4$

$y = 2x - 8$

$y_{\text{int}} = -8,\ m = 2$

$y = 0 \rightarrow x_{\text{int}} = 4$

6. $y - 2x = 11$

$y = 2x + 11$

$y_{\text{int}} = 11,\ m = 2$

$y = 0 \rightarrow x_{\text{int}} = -\frac{11}{2}$

7. $4x - 2y = 8$

$y = 2x - 4$

$y_{\text{int}} = -4,\ m = 2$

$y = 0 \rightarrow x_{\text{int}} = 2$

8. $\frac{1}{3}y = x + 5$

$y = 3x + 15$

$y_{\text{int}} = 15,\ m = 3$

$y = 0 \rightarrow x_{\text{int}} = -5$

9. $3(x + 2y) - 12 = 0$

$y = -\frac{1}{2}x + 2$

$y_{\text{int}} = 2,\ m = -\frac{1}{2}$

$y = 0 \rightarrow x_{\text{int}} = 4$

10. $\frac{1}{2}(y - 4x) = 3$

$y = 4x + 6$

$y_{\text{int}} = 6,\ m = 4$

$y = 0 \rightarrow x_{\text{int}} = -\frac{3}{2}$

11. $\frac{y-5}{x-2}=4 \Rightarrow y-5=4x-8 \Rightarrow y=4x-3$

12. $\frac{y-0}{x-0}=\frac{1}{2} \Rightarrow y=\frac{1}{2}x$

13. $\frac{y-0}{x-2}=-2 \Rightarrow y=-2x+4$

14. $\frac{y-4}{x-(-3)}=6 \Rightarrow y-4=6x+18 \Rightarrow y=6x+22$

15. $\frac{y-2}{x-(-2)}=-3 \Rightarrow y-2=-3x-6 \Rightarrow y=-3x-4$

16. $m=\frac{4-8}{1-3}=2$ $\quad \frac{y-4}{x-1}=2 \Rightarrow y-4=2x-2 \Rightarrow y=2x+2$

17. $m=\frac{-1-1}{-1-3}=\frac{1}{2}$ $\quad \frac{y-(-1)}{x-(-1)}=\frac{1}{2} \Rightarrow y+1=\frac{1}{2}x+\frac{1}{2} \Rightarrow y=\frac{1}{2}x-\frac{1}{2}$

18. $m=\frac{2-2}{4-8}=0$ $\quad \frac{y-2}{x-4}=0 \Rightarrow y=2$

19. $m=\frac{3-(-1)}{5-1}=1$ $\quad \frac{y-3}{x-5}=1 \Rightarrow y-3=x-5 \Rightarrow y=x-2$

20. $m=\frac{2-4}{-2-6}=\frac{1}{4}$ $\quad \frac{y-2}{x-(-2)}=\frac{1}{4} \Rightarrow y-2=\frac{1}{4}x+\frac{1}{2} \Rightarrow y=-\frac{1}{4}x+\frac{5}{2}$

21. $d=\sqrt{(4-1)^2+(8-4)^2}=5$

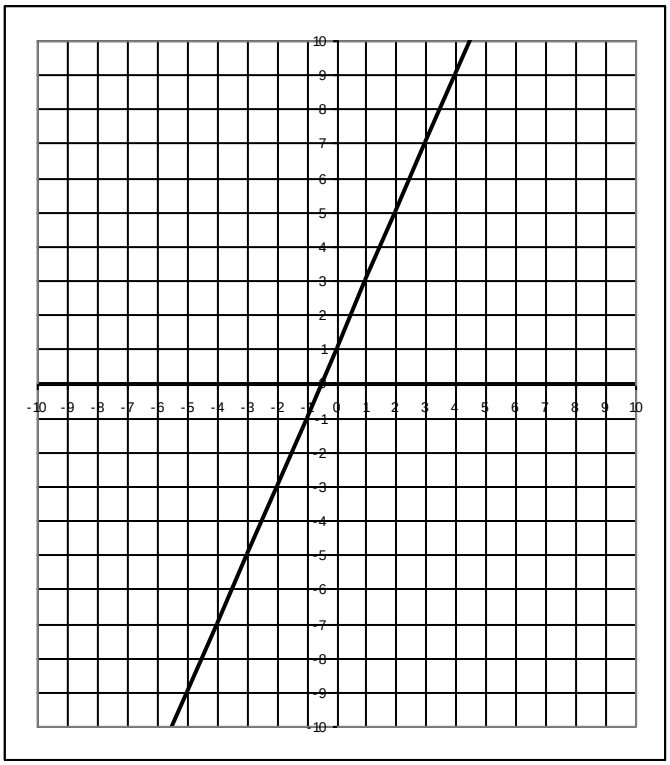
22. $d=\sqrt{(10-(-2))^2+(7-2)^2}=13$

23. $d=\sqrt{(9-3)^2+(3-(-5))^2}=10$

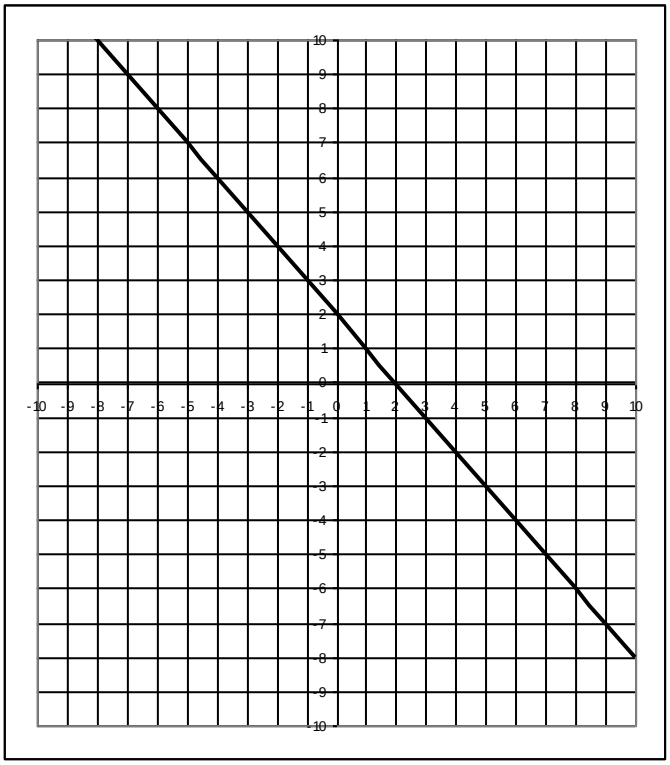
24. $d=\sqrt{(4-1)^2+(-4-(-1))^2}=4.24$

25. $d=\sqrt{(-17-7)^2+(7-14)^2}=25$

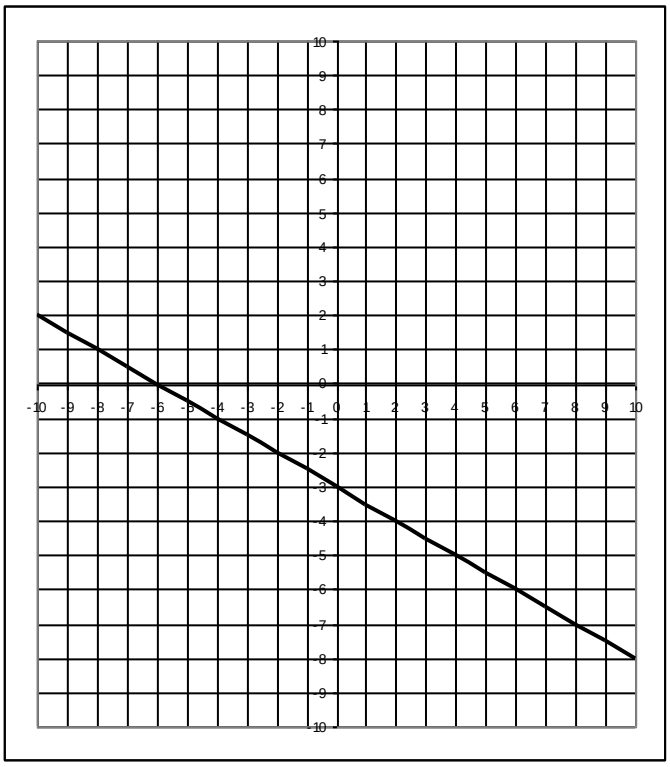
26. $y = 2x + 1$



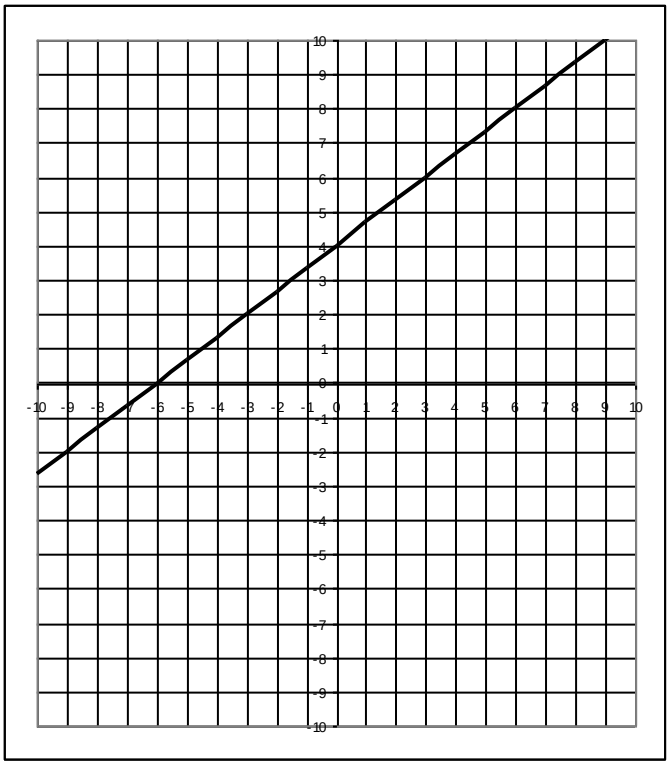
27. $y = -x + 2$



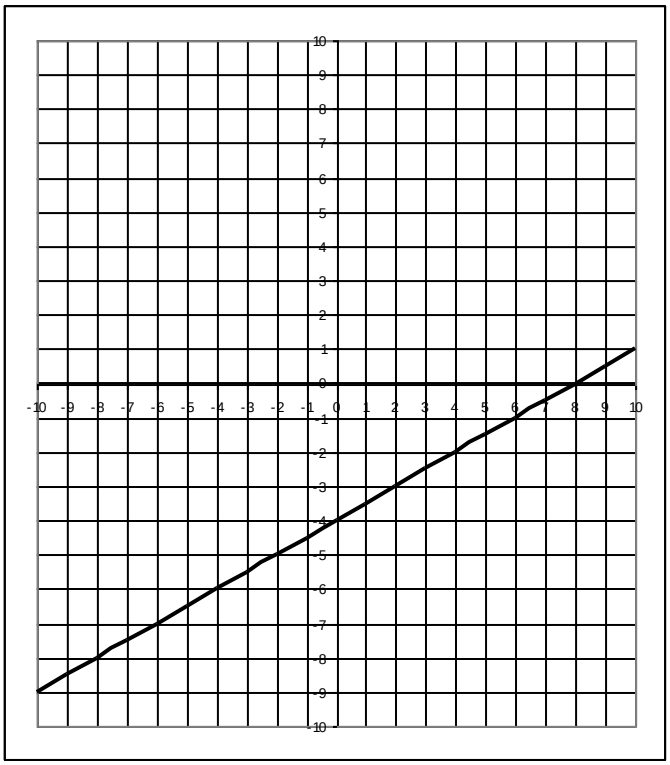
28. $y = -\frac{1}{2}x - 3$



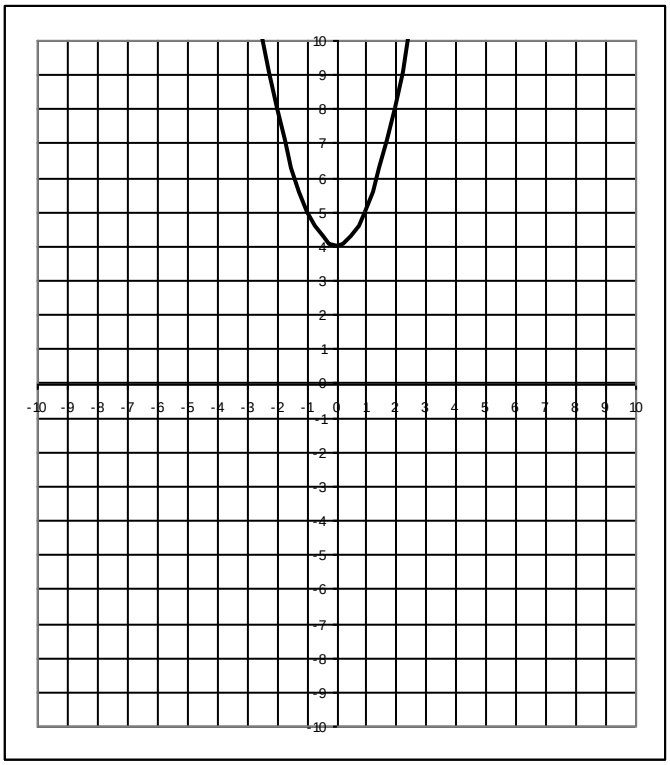
29. $2x - 3y = -12$



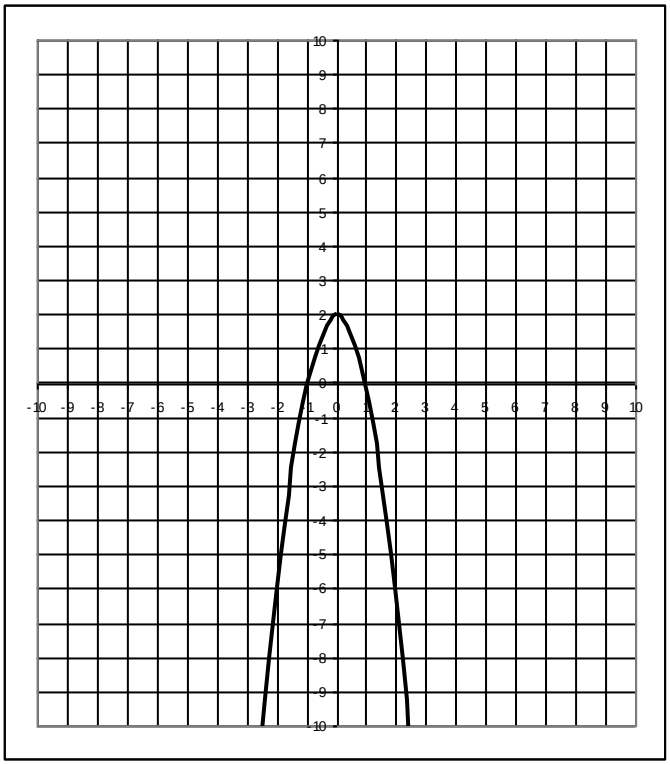
30. $x = 2y - 8$



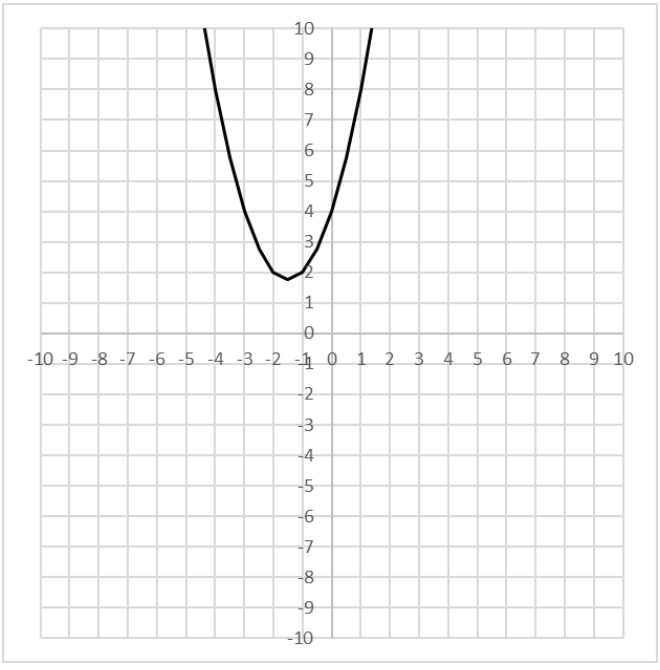
31. $y = x^2 + 4$



32. $y = 2 - 2x^2$



33. $y = x^2 + 3x + 4$



Chapter 5 – Sequences and Summations

Sequences

1. (a) $S_2 = 3(5) + 2 = 17$

   (b) $S_3 = 3(17) + 2 = 53$

   (c) $S_4 = 3(53) + 2 = 161$

2. (a) $P_3 = 8 - 2 = 6$

   (b) $P_4 = 6 - 2 = 4$

   (c) $P_5 = 4 - 2 = 2$

3. (a) $13 = 2R_3 - 5 \Rightarrow R_3 = 9$

   (b) $9 = 2R_2 - 5 \Rightarrow R_2 = 7$

   (c) $7 = 2R_1 - 5 \Rightarrow R_1 = 6$

4. (a) $S_2 = (3)^2 + 3 = 12$

   (b) $S_3 = (12)^2 + 12 = 156$

   (c) $S_4 = (156)^2 + 156 = 24492$

5. (a) $191 = 4P_3 + 3 \Rightarrow P_3 = 47$

   (b) $47 = 4P_2 + 3 \Rightarrow P_2 = 11$

   (c) $11 = 4P_1 + 3 \Rightarrow P_1 = 2$

Summations

6. $Q_1 = 6$

   $Q_2 = 2(6) - 4 = 8$

   $Q_3 = 2(8) - 4 = 12$

   $Q_4 = 2(12) - 4 = 20$

   46

7. $U_1 = 3$

   $U_2 = (3)^2 - 5 = 4$

   $U_3 = (4)^2 - 5 = 11$

   $U_4 = (11)^2 - 5 = 116$

   134

8. $Z_2 = 4$

   $Z_3 = \frac{1}{2}(4) + 8 = 10$

   $Z_4 = \frac{1}{2}(10) + 8 = 13$

   27

9. $(3)^2 - 2(3) + 5 = 8$

   $(4)^2 - 2(4) + 5 = 13$

   $(5)^2 - 2(5) + 5 = 20$

   $(6)^2 - 2(6) + 5 = 29$

   70

10. $4(1)^2 + 7 = 11$

$4(2)^2 + 7 = 23$

$4(3)^2 + 7 = 43$

$4(4)^2 + 7 = 71$

148

11. $(2)^2 + 3(2) - 9 = 1$

$(3)^2 + 3(3) - 9 = 9$

$(4)^2 + 3(4) - 9 = 19$

29

12. $3(1) + 1 = 4$

$3(2) + 1 = 7$

$3(3) + 1 = 10$

$3(4) + 1 = 13$

$3(5) + 1 = 16$

50

Chapter 6 – Logarithms

1. $\log_5 125 = x$

$5^x = 125$

$5^x = 5^3$

$x = 3$

2. $\log_5 25 = x$

$5^x = 25$

$5^x = 5^2$

$x = 2$

3. $\log_3 81 = x$

$3^x = 81$

$3^x = 3^4$

$x = 4$

4. $\log_4 16 = x$

$4^x = 16$

$4^x = 4^2$

$x = 2$

5. $\log_4 2 = x$

$4^x = 2$

$4^x = 4^{\frac{1}{2}}$

$x = \frac{1}{2}$

6. $\log_6 216 = x$

$6^x = 216$

$6^x = 6^3$

$x = 3$

7. $\log_x 49 = 2$

$x^2 = 49$

$x^2 = 7^2$

$x = 7$

8. $\log_x 243 = 5$

$x^5 = 243$

$x^5 = 3^5$

$x = 3$

9. $\log_x 64 = 6$

$x^6 = 64$

$x^6 = 2^6$

$x = 2$

10. $\log_x 625 = 4$

$x^4 = 625$

$x^4 = 5^4$

$x = 5$

11. $\log_x 36 = 2$

$x^2 = 36$

$x^2 = 6^2$

$x = 6$

12. $\log 10 = x$

$10^x = 10$

$10^x = 10^1$

$x = 1$

13. $\log 1000 = x$

$10^x = 1000$

$10^x = 10^3$

$x = 3$

14. $\log x = 5$

$10^5 = x$

$x = 100000$

15. $\log x = 7$

$10^7 = x$

$x = 10000000$

16. $\log_2 8 = 3$

17. $\log_4 64 = 3$

18. $\log_{12} 144 = 2$

19. $\log 100000 = 5$

20. $\log 1000 = 3$

21. $\log 100 = 2$

22. $\log_3 9 = 2$

23. $\log_2 2 = 1$

24. $\log_2 8 = 3$

25. $\log_4 64 = 3$

26. $\log_3 27 = 3$

27. $\log_5 25 = 2$

28. $\log 10 = 1$

29. $\log 100 = 2$

30. $\log 0.1 = -1$

Chapter 7 – Logic

1.

(a) If it is human then it is a mammal.

(b) If you apply for your pension then you must have resigned.

(c) If you are a member then you may run for office.

(d) If the beam is broken then the bell will sound.

(e) If you have three accident-free years then your premium will drop back to its prior category.

(f) If you pass a means test then you may apply for the supplement.

(g) If you get a positive result on this test then it means you are still infected.

2.

	Mike	George	Jim	Ed	1st	2nd	3rd	4th
Thunder	✓	x	x	x	x	x	✓	x
Lightning	x	✓	x	x	x	x	x	✓
Tempest	x	x	x	✓	✓	x	x	x
Blizzard	x	x	✓	x	x	✓	x	x
1st	x	x	x	✓				
2nd	x	x	✓	x				
3rd	✓	x	x	x				
4th	x	✓	x	x				

First Place – Ed and Tempest

Second Place – Jim and Blizzard

Third Place – Mike and Thunder

Fourth Place – George and Lightning

3. (a) There are multiple possible answers. For example, watermelons, pears, tangerines and oranges.

(b) Tangerines or Kiwis are the possible fruit that can be on the stand if only one is available.

(c) Yes, the stand can carry both oranges and tangerines.

(d) One possible set of four fruit is pears, oranges, waternelons, tangerines.

Five types of fruit can be on the stand if figs are also included.

4. (b) Freight transportation should not be heavily automated is the conclusion being drawn by the author. The premise of the argument can be found where the author indicates, "Yet, this should be rejected," where this refers to "significantly greater automation of freight transportation."

Practice Test Solutions

Section 1 – Algebra and Arithmetic

1. $\frac{3}{10}$
2. $x = 2,\ y = 3$
3. 10
4. $y = -2x + 11$
5. $4 + 9 + 16 + 25 = 54$
6. $x = 18$
7. $y = 3, 4$
8. Carpentry – \$25,000; Mechanical – \$50,000; Electrical – \$75,000: Total = \$150,000

Section 2 – Graphing and Memo

1. $y = 2x^2 + 7x + 3$
2. It is important to prepare a memo that has three distinct sections:

   (1) A short introductory paragraph – this section should characterize the topic or area being examined by the data. In this example, it should be noted that trends in carbon emissions and GDP for the provinces and territories of Canada are being examined over the period 1990 to 2018. This paragraph should identify your thesis, or significant phenomenon being presented in your memo.

   (2) The body of your memo – this section should contain 3 – 5 observations you have made in the data that support the thesis you are presenting. Be sure to look for trends that increase, decrease, stay unchanged, or change at different rates, and position these points relative to your thesis. In this example, there are some regions of Canada that experienced increases in GDP and carbon emissions; there are some regions that experienced increases in GDP and decreases in carbon emissions; there are some that have seen minimal changes in GDP and flat or increasing carbon emissions.

   (3) A concluding paragraph – this section should summarize the importance or significance of the phenomenon you are presenting. Draw conclusions that link the tables, highlight the implications of the phenomenon on future trends, or discuss additional data that could be useful to further understand or elaborate on the phenomenon. In this example, there is not a consistent relationship between GDP and carbon emissions across Canada, so your memo should discuss the various reasons for this; the potential implications this has on the environment, economy and politics; the potential information that could provide additional insights – such as population numbers or other demographic information.

Section 3 – Logic

1.

	Edna	Faye	Gina	Helen	2	4	6	8
Alan	x	x	x	✓	x	x	x	✓
Bob	x	✓	x	x	x	✓	x	x
Cyril	x	x	✓	x	x	x	✓	x
Dan	✓	x	x	x	✓	x	x	x
2	✓	x	x	x				
4	x	✓	x	x				
6	x	x	✓	x				
8	x	x	x	✓				

Create the above grid and check off possible connections by entering a ✓ for yes and a x for no. Bracketed letters refer to clues in the original problem.

(i) Bob is in 4 (a)

(ii) Cyril is married to Gina (b and c)

(iii) Dan is married to Edna (f)

(iv) Cyril lives in 6 (a and c)

(v) Helen lives in 8 (a and e)

(vi) Since he's not married to Helen, Dan lives in 2

(vii) Alan is married to Helen

2. (c) The original best-practices for the depth of the supports failed to anticipate future changes in demand or engineering theory is the conclusion that can be drawn. Two reasons are given for reinforcing: (1) "updated engineering practice and theory" (2) "to meet anticipated increase in use." Since the changes must be made for these two reasons, we can conclude that the original standards did not anticipate these two reasons/factors.