Mathematics for the Senior Phase

Grade 7 - Grade 9

Solutions Booklet

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Acknowledgements

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Everything Mathematics Grade 10 textbook (www.everythingmaths.co.za) for the diagram on the number system on Unit 1.1. Wits Maths Connect project for Question 16 of Unit 1.9. ANA exemplar from DBE for Questions 7 – 9 of Unit 3.4. Ukuqonda Mathematics workbooks for Grades 7 – 9 published by the Institute and Sasol Inzalo Foundation: Question 4 and 7 from Unit 1.5; Protractor diagram in Unit 3.1; Questions 2 – 13 in Unit 3.1; Questions 5 – 12 in Unit 3.2; Questions 5 and 7 from Unit 3.3; Questions 1, 2 and 10 – 12 from Unit 3.4; The diagrams and questions in Unit 3.5; The diagrams and questions in Unit 3.6; Questions 8 – 10 in Unit 4.1; Question 18 from Unit 4.2.

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This learner book is not intended to replace the learner's textbook in the classroom.

Worked Solutions to Questions

NUMBER
Unit 1.1: The Number System

1. a) –30,125; $\sqrt{\frac{36}{64}} = \frac{6}{8} = \frac{3}{4}$; 34%= $\frac{34}{100}$

   b) $\sqrt{0{,}01} = 0{,}1$; $4^3 = 64$

   c) $-\frac{1}{2}$; 5,23168238

   d) $\frac{22}{7}$; 0,00005; –12; $\sqrt{1{,}44} = 1{,}2$

2. a) Examples are –105; –37; –0,46; $-\frac{2}{3}$; $-3\frac{1}{5}$

   b) Examples are 0,46; $\frac{2}{3}$; $3\frac{1}{5}$; $\frac{16}{5}$; 0,0001

3. a) Examples are 0,15; 0,11; 0,19; 0,125

   b) Examples are 0,361; 0,365; 0,3615; 0,36001; 0,36999

   c) Use decimals or common fractions

   eg $\frac{7}{24}$ because $\frac{1}{4} = \frac{6}{24}$ and $\frac{1}{3} = \frac{8}{24}$; 0,26 and

   0,32 because $\frac{1}{3}$ = 0,333… and $\frac{1}{4}$ = 0,25.

4. There are an infinite number of numbers between $\frac{1}{4}$ and $\frac{1}{2}$.

5. Examples are 0,11; 0,15; 0,19; 0,119; 0,1991

6. a) 1 is the closest integer to 1,3.

   b) 1,29 or 1,299 or 1,29999 etc

   c) 1,299999 or 1,299991 etc

   d) No. There will always be another number even closer to 1,3.

7. a) No. π is an irrational number 3,1416…

   $\frac{22}{7}$ is a rational number with a value very close to π.

   b) 3 is closest to π.

8. a) $\sqrt[3]{-1} = -1$ so statement is true.

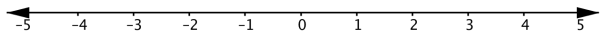
   b) 0 = $\frac{0}{1}$ so statement is true.

   c) True because all integers are also rational numbers.

   d) False. Not all integers are natural numbers.

   All negative integers are not natural numbers.

9.



$\sqrt[3]{-8}$ $-\frac{5}{3}$ 0,3473256 $\sqrt{2}$ $\frac{\pi}{2}$

Unit 1.2: Operations on whole numbers

1a.

	$^{1}\not{2}$	$^{1}3$	8	7	6	9
–	1	4	1	4	5	3
		9	7	3	1	6

b.

	$^{1}2$	$^{1}4$	$^{1}5$	$^{1}0$	2
+		3	5	7	9	8
		6	0	3	0	0

c.

	2	$^{2}\not{3}$	$^{9}\not{0}$	$^{9}\not{0}$	$^{1}1$
–	2	2	9	9	9
					2

d. 354 231 – 320 000 = 34 231 (54 000 – 20 000)

e. 378 × 45

	$^{3}3$	$_{3}4$7	8	
	×	4	5	
$^{1}1$	$^{1}8$	9	0	
1	5	1	2	0
1	7	0	1	0

f.

		$^{1}4$	$_{2}^{1}2$	6	
	×	2	4	3	
	1	$^{1}2$	7	8	
$^{1}1$	7	0	4	0	
8	5	2	0	0	
1	0	3	5	1	8

2.a

		8	9	3
7	6	2	$^{6}5$	$^{2}1$

b.

		5	6	2
4	2	2	$^{2}4$	8

c. 99 876 × 322 = 32 160 072

			9	9	8	7	6	
			×		3	2	2	
		1	9	9	7	5	2	
	1	9	9	7	5	2	0	
2	9	9	6	2	8	0	0	
3	2	1	6	0	0	7	2	

3.

		3	5	6
12	4	2	7	2

The farmer needs 356 boxes.

4.

				4	5
500	2	2	5	0	0
–	2	0	0	0	
		2	5	0	0
		2	5	0	0
					0

Mr Mohapi sells his chairs at R45 each.

			4	8
200	9	6	0	0
–	8	0	0	
	1	6	0	0
	1	6	0	0
				0

Mrs Shuma sells her chairs at R48 each.

So Mr Mohapi's chairs are cheaper.

5. 120 × 57 = 6 840 for the T-shirts
   7 000 – 6 840 = 160
   R160 left over.
6. 50 boxes × 36 bananas = 1 800 bananas.
   1 800 – 18 = 1 782 bananas sold.
   1 782 ÷ 3 = 594 bags
   594 × R4 = R2 376
   R2 376 – R452 = R1 924 profit.
7. 34,50 + 24,65 + 13,25 + 27,50 + 25,70
   = R125,60. So R100 is not enough.
8. a) 2 453 + 1 072 = 3 525
   b) 5 × 735 = 3 675
   c) 14 391 – 9 870 = 4 521
   d) 1 161÷ 3 = 387
   e) 345 – 246 + 123 = 222
   f) 7 × 46 + 21 = 343

9a. Round off to estimate:
   2 215 + 3 014 + 5 986
   ≈ 2 200 + 3 000 + 6 000 = 11 200
b. 3 962 ÷ 9 ≈ 4 000 ÷ 10 = 400 OR
   3 962 ÷ 10≈ = 396,2
c. 32 × 47 ≈ 30 × 50 = 1 500
d. 999 × 103 ≈ 1 000 × 100 = 100 000

10a. smaller because 4 is half of 8
b. 4 × 54 = 8 × 27
   because 4 is half of 8 and 27 is half of 54
c. 24 is three times bigger than 8, but 12 is bigger than one third of 27, so it is larger.
d. 5 × 8 × 27 ÷ 2. 5 × 8 is 5 times bigger than 8; 27 ÷ 2 is not one fifth of 27. It is larger.
   So the sum is larger than 8 × 27

11. 3 546 – 2 397
a. We subtract 2 398 so the answer is smaller.
b. The answers are equal because both numbers are one bigger than the original sum.
c. We subtract from 3 547, so the answer is one larger than in the original sum.

12a) 399 × 400 estimate: 160 000
The actual answer is smaller because 399 is smaller than the estimate of 400 for it.
b) 6 052 ÷ 30 estimate: 200
The actual answer is larger because 6 052 is larger than the estimate of 6 000 for it.
c) 80 000 ÷ 380 estimate: 200
The actual answer is smaller because 380 is smaller than the estimate of 400 for it.

13. $67 \times 63 = 4\,221$.
   a) 67×630 = 42 210.
   b) $6\,700 \times 6\,300$ = 42 210 000
   c) $4\,221 \div 63$ = 67
   d) $68 \times 63 = (67 \times 63) + (1 \times 63)$
   $= 4\,221 + 63 = 4\,284$

Unit 1.3: Multiples, factors and primes

Grade 7, 8 & 9

1. A prime number is any whole number greater than 1 that only has one and itself as factors.
2 A composite number is a number that has more than two factors.
3. No. A prime number must be greater than 1
4. 1 is a factor of every number.
5. 2; 3; 5; 7; 11; 13; 17.
6. 2 is a factor of all even numbers.
7a. 24; 48; 8; 2; 1.
 b. 24; 48
 c. 13; 2
8a. 1; 2; 3; 4; 6; 12.
 b. 1; 2; 3; 4; 6; 8; 12; 24.
 c. 1; 3; 7; 9; 21; 63
 d. 1; 7; 49
 e. No. It can be divided by 3.
 f. 8 is the HCF for 8 and 16.
 g. Factors of 18: 1, 2, 3, 6, 9, 18
    Factors of 24: 1, 2, 3, 4, 6, 8, 12, 24.
    HCF is 6 and LCM is 48
 h. Factors of 36: 1, 2, 3, 4, 9, 12, 18, 36.
    Factors of 99: 1, 3, 9, 11, 33, 99.
    Therefore 9 is the HCF
    $36 = 2^2 \times 3^2$ and $99 = 3^2 \times 11$
    Therefore LCM is $2^2 \times 3^2 \times 11 = 396$
 i. $8 = 2^3$ $16 = 2^4$ $24 = 2^3 \times 3$
    Therefore HCF is 2^3 or 8 and LCM is $2^4 \times 3 = 48$
 j. 140 = 2 x 2 x 5 x 7 and 168 = 2 x 2 x 2 x 3 x 7
    Therefore HCF is 2^2 x 7 = 28
 k. 1 820 = 2 x 2 x 5 x 7 x 13
 l. 3 510 = 2 x 3 x 3 x 3 x 5 x 13
 m. 315 = 3 x 3 x 5 x 7
 n. 1 320 = 2 x 2 x 2 x 3 x 5 x 11
10. Factors of 4: 1, 2 and 4
    Factors of 9: 1, 3 and 9
    Factors of 25: 1, 5 and 25
11. 6 has factors 1, 2, 3 and 6
    8 has factors 1, 2, 4 and 8
    10 has factors 1, 2, 5 and 10
12. 16 has factors 1, 2, 4, 8, 16.
13. Examples: 24 and 60; 12 and 36.
14. Examples: 12 and 72; 36 and 84.
15. 15; 30; 45; 60; 75; 90
16. 21; 42; 63; 84.

Grade 8 & 9

17. 1 820 = 2^2 x 5 x 7 x 13
    3 510 = 2 x 3^3 x 5 x 13
    HCF is 2 x 5 = 10
18. LCM = 2^2 x 3^3 x 5 x 7 x 13 = 49 140
19. 315 = 3 x 3 x 5 x 7 and 1 320 = 2 x 2 x 2 x 3 x 5 x 11
    HCF = 3 x 5 = 15
20. LCM = 2^3 x 3^2 x 5 x 7 x 11 = 27 720
21. 12 and 35; 15 and 28; 20 and 21.

22. 70 and 6. Use the prime factors of 420 to make two factors as in Q 21.

23a. LCM of a and b is ab

b. HCF of a and b is a because it is a factor of b.

24a. LCM of a and b is ab

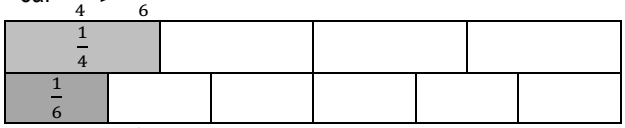
b. HCF of a and b is also ab.

Unit 1.4: Common fractions

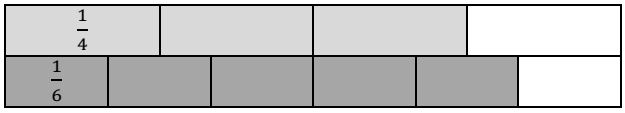
Grade 7, 8 & 9

1. $\frac{2}{5}$
2. $\frac{1}{7}$
3. $\frac{3}{8}$
4. 3 blocks out of 15 are shaded.

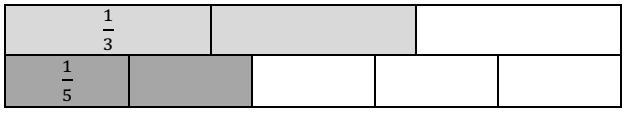
5a. $\frac{1}{4} > \frac{1}{6}$



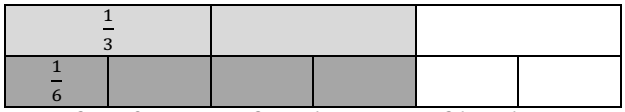
b. $\frac{3}{4} < \frac{5}{6}$



c. $\frac{2}{3} > \frac{2}{5}$



d. $\frac{2}{3} = \frac{4}{6}$



6a. $\frac{3}{5} = \frac{9}{15}$ b. $\frac{2}{7} = \frac{6}{21}$ c. $\frac{24}{28} = \frac{6}{7}$

d. $\frac{25}{30} = \frac{5}{6}$

7a. $\frac{23}{5} = 4\frac{3}{5}$ b. $\frac{36}{11} = 3\frac{3}{11}$ c. $\frac{8}{3} = 2\frac{2}{3}$

d. $\frac{12}{4} = 3$

8a. $5\frac{1}{3} = \frac{16}{3}$ b. $4\frac{6}{11} = \frac{50}{11}$ c. $7\frac{2}{3} = \frac{23}{3}$

d. $6\frac{3}{4} = \frac{27}{4}$

9a. $\frac{3}{8} + \frac{5}{8} = \frac{8}{8} = 1$ b. $\frac{7}{9} - \frac{2}{9} = \frac{5}{9}$

c. $4\frac{2}{5} + 3\frac{1}{5} = 7\frac{3}{5}$

d. $6\frac{1}{3} - 2\frac{2}{3} = 5 + 1 + \frac{1}{3} - 2\frac{2}{3} = 3\frac{2}{3}$

e. $\frac{5}{6} + \frac{1}{4} = \frac{10}{12} + \frac{3}{12} = \frac{13}{12} = 1\frac{1}{12}$

f. $\frac{2}{9} + \frac{3}{5} = \frac{10}{45} + \frac{27}{45} = \frac{37}{45}$

g. $\frac{17}{24} - \frac{1}{6} = \frac{17}{24} - \frac{4}{24} = \frac{13}{24}$

h. $3\frac{3}{5} + 2\frac{1}{6} = \frac{18}{5} + \frac{13}{6} = \frac{108}{30} + \frac{65}{30} = \frac{173}{30} = 5\frac{23}{30}$

i. $2\frac{1}{3} - 1\frac{2}{4} = \frac{7}{3} - \frac{6}{4} = \frac{28}{12} - \frac{18}{12} = \frac{10}{12} = \frac{5}{6}$

j. $\frac{1}{6} \times \frac{2}{9} = \frac{1}{27}$

k. $\frac{2}{11} \times \frac{33}{46} = \frac{3}{23}$

l. $\frac{16}{21} \times \frac{3}{4} = \frac{4}{7}$

m. $1\frac{3}{7} \times 2\frac{1}{3} = \frac{10}{7} \times \frac{7}{3} = \frac{10}{3} = 3\frac{1}{3}$

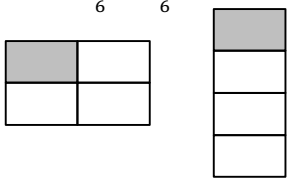
n. $3\frac{2}{5} \times 1\frac{1}{4} = \frac{17}{5} \times \frac{5}{4} = \frac{17}{4} = 4\frac{1}{4}$

o. $\frac{2}{3} \times \left(1 + \frac{1}{2}\right) = \frac{2}{3} \times \frac{3}{2} = 1$

p) $\frac{3}{4} \times \frac{4}{5} + 1\frac{2}{5} = \frac{3}{5} + 1\frac{2}{5} = 2$

10. $2\frac{1}{2} + 3\frac{2}{3} = 5 + \frac{3}{6} + \frac{4}{6} = 6\frac{1}{6}$ and $10 - 6\frac{1}{6} = 3\frac{5}{6}$.
I have $3\frac{5}{6}$ fizzers left.

11. It would be 4 times the size of the block



12. a. 60 is $\frac{1}{4}$ of 240 b. 60 is $\frac{3}{4}$ of 80

13. 40 minutes out of 90 minutes = $\frac{40}{90} = \frac{4}{9} = \frac{2}{3}$

14. $4\frac{2}{3} = 4 \times \frac{3}{3} + \frac{2}{3} = \frac{14}{3}$. So there are 14 one thirds in $4\frac{2}{3}$

15. $\frac{3}{4} + \frac{3}{4} + \frac{3}{4} + \frac{3}{4}$ = 3 litres in 4 bottles.
One more $\frac{3}{4}$ from 4th litre. So 5 bottles can be filled.

16. a) $\frac{3\,987}{11\,961} = \frac{443}{1\,329} = \frac{1}{3}$ or $\frac{4\,000}{12\,000} = \frac{1}{3}$
b) $\frac{4\,952}{14\,856} = \frac{619}{1\,857} = \frac{1}{3}$ or $\frac{5\,000}{15\,000} = \frac{1}{3}$
c) $\frac{2\,997}{8\,991} = \frac{3\,000}{9\,000} = \frac{1}{3}$ d) $\frac{5\,996}{21\,879} = \frac{6\,000}{22\,000} = \frac{3}{11}$
e) $\frac{1\,999}{5\,997} = \frac{3\,000}{9\,000} = \frac{1}{3}$ So d) is not equivalent to $\frac{1}{3}$

17. I drank $\frac{1}{4}$ of $\frac{1}{2}$ litre = $\frac{1}{8}$ of a litre. So there is $\frac{1}{8}$ of a litre of orange juice left.

18. ½ million rand out of ¾ million rand
= 500 000 out of 750 000 = $\frac{50}{75} = \frac{2}{3}$ of his winnings
= $\frac{3}{8} \times 1\,000\,000 = \text{R}375\,000$

19. $\frac{5}{8} \times x = 25. so\ x = 25 \times \frac{8}{5} = 40$. The number is 40.

20. R32 × 2½ = 32 × $\frac{5}{2} = 80$. I must pay R80.

21. $\frac{3}{4} \times 6 = \frac{9}{2} = 4\frac{1}{2}$. I need $4\frac{1}{2}$ cups of flour.

22. $\frac{3}{4}$ of money is R60.
So $\frac{1}{4}$ of money is R20. I spend R20.

23. 16 sausages ÷ 5 children = 3 each and $\frac{1}{5}$ of the last sausage.
So they get $3\frac{1}{5}$ each.

24. $\frac{3}{4}$ kg of flour × x loaves of bread = 10 kg
$\frac{3}{4}x$ = 10 so x = $10 \times \frac{4}{3}$ = $13\frac{1}{3}$ loaves of bread

Grade 8 & 9

a) $6 \div \frac{3}{4} = 6 \times \frac{4}{3} = 8$ b) $3\frac{1}{3} \div \frac{5}{9} = \frac{10}{3} \times \frac{9}{5} = 6$

c) $\frac{5}{8} \div 2 = \frac{5}{8} \times \frac{1}{2} = \frac{5}{16}$

d) $2\frac{1}{6} \div 1\frac{1}{3} = \frac{13}{6} \div \frac{4}{3} = \frac{13}{6} \times \frac{3}{4} = \frac{13}{8} = 1\frac{5}{8}$

e) $1\frac{4}{5} - \frac{8}{15} \div 1\frac{1}{2} = \frac{9}{5} - \left(\frac{8}{15} \div \frac{3}{2}\right) = \frac{9}{5} - \left(\frac{8}{15} \times \frac{2}{3}\right)$

$= \frac{9}{5} - \frac{16}{45} = \frac{81}{45} - \frac{16}{45} = \frac{65}{45} = \frac{13}{9} = 1\frac{4}{9}$

f) $\left(\frac{3}{4} \times \frac{4}{7}\right) - \left(\frac{6}{7} \div 3\right) = \frac{3}{7} - \left(\frac{6}{7} \times \frac{1}{3}\right) = \frac{3}{7} - \frac{2}{7} = \frac{1}{7}$

Unit 1.5: Decimal numbers

Grade 7, 8 & 9

1a) 0,8 = $\frac{8}{10} = \frac{4}{5}$ b) 0,02 = $\frac{2}{100} = \frac{1}{50}$

c) 0,005 = $\frac{5}{1\,000} = \frac{1}{200}$ d) 0,25 = $\frac{25}{100} = \frac{1}{4}$

e) 0,305 = $\frac{305}{1\,000} = \frac{61}{200}$ f) 4,05 = $4\frac{5}{100} = 4\frac{1}{20}$

g) 80,75 = $80\frac{75}{100} = 80\frac{3}{4}$ h) 3,12 = $3\frac{12}{100} = 3\frac{3}{25}$

i) 54,89 = $54\frac{89}{100}$ j) 10,379 = $10\frac{379}{1\,000}$

2a) $\frac{2}{10} = 0{,}2$ b) $\frac{7}{100} = 0{,}07$

c) $\frac{9}{1\,000} = 0{,}009$ d) $\frac{43}{100} = 0{,}43$

e) $\frac{231}{1\,000} = 0{,}231$ f) $\frac{34}{1\,000} = 0{,}034$

g) $\frac{1}{5} = \frac{2}{10} = 0{,}2$ h) $\frac{3}{4} = \frac{75}{100} = 0{,}75$

i) $3\frac{14}{100} = 3{,}14$ j) $10\frac{1}{2} = 10\frac{5}{10} = 10{,}5$

3a) 0,3 = $\frac{3}{10} = \frac{300}{1\,000}$; 0,03 = $\frac{3}{100} = \frac{30}{1\,000}$;

0,042 = $\frac{42}{1\,000}$

So ascending order is 0,03; 0,042; 0,3

b) 0,2 = 0,20; 0,21; 0,12

So ascending order is 0,12; 0,2; 0,21

c) 0,7 = 0,7000; 0,3256; 0,09 = 0,0900

So ascending order is 0,09; 0,3256; 0,7

d) 0,980; 1,000; 0,0643

So ascending order is 0,0643; 0,98; 1

e) 0,78; 0,60; 0,09

So ascending order is 0,09; 0,6; 0,78

f) 0,0045; 0,0060; 0,0100

So ascending order is 0,0045; 0,006; 0,01

4a) Number line goes up in intervals of 0,01.

So A is 3,09; B is 3,14; C is 3,19;

D is 3,265 (halfway between 3,26 and 3,27)

b) Number line goes up in intervals of 0,001.

So A is 0,4499; B is 0,4502; C is 0,4505; D is 0,4509

5a) Rounding 6 543,2348: (i) 7 000 (ii) 6 540
(iii) 6 543,2 (iv) 6543,235

b) Rounding 7 269,8063: (i) 7 300 (ii) 7 270
(iii) 7 270,0 (iv) 7 269,81

c) Rounding 6 399,2318: (i) 6 000 (ii) 6 400
(iii) 6 399,2 (iv) 6 399,232.

d) Round off 6 053,7247: (i) 6 100 (ii) 6 050
(iii) 6 053,7 (iv) 6 053,725.

e) Round off 689,9828: (i) 1 000 (ii) 690
(iii) 690,0 (iv) 689,983

6a) 3,30 + 4,83 = 8,13 b) 9,4 + 3,7 = 13,1

c) 3,560 + 4,689 = 8,249 d) 9,43 – 3,21 = 6,22

e) 9,43 – 3,56 = 5,87 f) 0,06 + 3,2 + 5,75 = 8,81

g) 0,07 + 4,21 – 4,2 = 0,08 h) 1 – 0,03 = 0,97

i) 100 – 0,03 = 99,07 j) 0,04 + 5,06 = 5,1

7a) 13,3 + 1,4 + ___ = 18,2 So 18,2 – 14,7 = 3,5

b) 25,31 – 10,25 = 15,06 c) 14,9 + 0,1 = 15

d) 14,09 + 0,91 = 15 e) 1 – 0,7 = 0,3

f) 1 – 0,22 = 0,78

8a) $51{,}7 \times 100 = 5\,170$ b) $0{,}2 \div 10 = 0{,}02$

c) $0{,}071 \times 1\,000 = 71$ d) $521{,}23 \div 100 = 5{,}2123$

e) $31{,}75 \times 10 = 317{,}5$ f) $0{,}03 \div 10$

g) $1{,}2 \div 100$ h) $2{,}6 \div 10$

i) $5\,413{,}217 \div 1\,000 = 5{,}413217$

9a) $4 \times 0{,}3 = 1{,}2$

b) $0{,}02 \times 0{,}3 = 0{,}006$ c) $7{,}2 \div 9 = 0{,}8$

d) $(0{,}1)^2 = 0{,}1 \times 0{,}1 = 0{,}01$

e) $451{,}2 \div 0{,}02 = 4{,}512 \div 2 = 2{,}456$

f) $2{,}1 \div 0{,}3 = 21 \div 3 = 7$

g) $5{,}365 \div 0{,}05 = 536{,}5 \div 5 = 107{,}3$

h) $1{,}44 \div 1{,}2 = 1{,}2$

i) $0{,}8 \times 3{,}81 = 3{,}048$

j) $1{,}2 \times 3{,}4 = 12 \times 34 \div 100$

$= 340 + 68 \div 100 = 4{,}08$

10 $45 \times 24 = 1\,080.$

a) $4{,}5 \times 2{,}4 = 10{,}80$

b) $0{,}045 \times 0{,}24 = 0{,}01080$

c) $0{,}45 \times 240 = 108{,}0$

11. $23 \times 37 = 851$

a) $2{,}3 \times 3{,}7 = 8{,}51$ b) $0{,}23 \times 0{,}37 = 0{,}0851$

c) $0{,}23 \times 370 = 85{,}1$

12a) $0{,}35 + (0{,}2 \times 0{,}1) = 0{,}35 + 0{,}02 = 0{,}37$

b) $(0{,}42 \div 0{,}2) + (3{,}1 \times 3) = 0{,}021 + 9{,}1 = 9{,}121$

c) $\frac{3{,}2 + 4{,}05}{0{,}05} = \frac{7{,}25}{0{,}05} = \frac{725}{5} = 125$

d) $0{,}75 + 0{,}1 \times 2 = 0{,}75 + 0{,}2 = 0{,}95$

e) $(0{,}24 \div 0{,}3) + (1{,}4 \times 2) = (2{,}4 \div 3) + 2{,}8$

$= 0{,}8 + 2{,}8 = 3{,}6$

f) $\frac{3{,}4 + 4{,}92}{0{,}02} = \frac{8{,}32}{0{,}02} = \frac{832}{2} = 416$

13a) R32,60 × 2 kg = R65,20

b) 0,2 kg cost R6,52

c) 0,5 kg cost = R16,30

14a) R14,06 × 5 kl = R14,06 × 10 ÷ 2 = R70,30

b) R14,06 × 6,5 kl = R70,30 + R14,06 + R7,03 = R91,39

15a) $(0{,}04)^2 = 0{,}016$ so 0,04 is bigger

b) $\sqrt{0{,}04} = 0{,}2$ so $\sqrt{0{,}04}$ is bigger.

c) $(0{,}3)^2 = 0{,}09$ so 0,3 is bigger

d) $\sqrt{0{,}3}$ is bigger (following the pattern of question b).

16a) 2,7; 3,0; 3,3; 3,6; 3,9; 4,2 (adding 0,3 each time).

b) 3,28; 3,3; 3,32; 3,34; 3,36; 3,38; 3,4.
(adding 0,02 each time)

c) 0,89; 0,81; 0,73; 0,65; 0,57; 0,49
(subtracting 0,08 each time).

d) 0,8; 1,6; 3,2; 6,4; 12,8; 25,6.
(doubling each time)

Unit 1.6: Percentages

Grade 7, 8 & 9

1a) 1% = 0,01 = $\frac{1}{100}$ b) 2% = 0,02 = $\frac{2}{100} = \frac{1}{50}$

c) 30% = 0,3 = $\frac{3}{10}$ d) 25% = 0,25 = $\frac{1}{4}$

e) 75% = 0,75 = $\frac{75}{100} = \frac{3}{4}$

f) 50% = 0,5 = $\frac{50}{100} = \frac{1}{2}$ g) 45% = 0,45 = $\frac{45}{100} = \frac{9}{20}$

h) 68% = 0,68 = $\frac{68}{100} = \frac{17}{25}$ i) 40% = 0,4 = $\frac{40}{100} = \frac{2}{5}$

j) 55% = 0,55 = $\frac{55}{100} = \frac{11}{20}$

2a) 4% b) 9% c) 60% d) 27%

e) 25% f) 80% g) 32% h) 100%

i) 29,5% j) 7,5%

3a) ¼ = $\frac{25}{100}$ = 0,25 = 25% b) ½ = 50%

c) ¾ = 75% d) $\frac{1}{25} = \frac{4}{100}$ = 4%

e) $\frac{2}{25} = \frac{8}{100}$ = 8% f) $\frac{3}{20} = \frac{15}{100}$ = 15%

g) $\frac{12}{50} = \frac{24}{100}$ = 24% h) $\frac{7}{20} = \frac{35}{100} = 35\%$

i) $\frac{3}{5} = \frac{60}{100}$ = 60% j) $\frac{9}{25} = \frac{36}{100}$ = 36%

4a) 15% = 0,15; $\frac{1}{5}$ = 0,2; 0,25

b) 0,02; $\frac{1}{25}$ = 0,04; 5% = 0,05

c) 3% = 0,03; $\frac{3}{10}$ = 0,3; 0,32

d) 0,06; 40% = 0,4; $\frac{23}{50}$ = 0,46.

e) 35% = 0,35; 0,4; ½ = 0,5

f) 0,1; $\frac{3}{25} = 0{,}12$; 15% = 0,15

5a) $\frac{10}{100} \times 600 = 60$ b) $\frac{25}{100} \times 368 = 92$

c) $\frac{75}{100} \times 328 = 246$ d) $\frac{20}{100} \times 125 = 25$

e) $\frac{40}{100} \times 500 = 200$ f) $\frac{30}{100} \times 12\,300 = 3\,690$

6a) $\frac{40}{100} \times 30 = 12$. The mark is 12 out of 30.

b) $\frac{24}{30} \times 100 = 80$. You get 80% for the test.

c) $\frac{25}{100} \times 60 = 15$. There are 15 boys at the camp.

d) $\frac{15}{100} \times 1\,000 = 150$. My brother gets R150.

e) 20% of water = 14 litres.

So 1% of water is $\frac{14}{20}$, so 80% is $\frac{14}{20} \times 80 = 56$ litres.

f) $\frac{11{,}90 - 10{,}00}{10{,}00} \times \frac{100}{1} = 19\%$.

The price of milk increases by 19%.

g) $\frac{16 - 40}{40} \times \frac{100}{1} = -60\%$. The percentage of people attending drops by 60%.

h) $\frac{20}{100} \times 600 = 120$.

So the shirt costs R600 – R120 = R480.

i) $\frac{14}{100} \times 150\,000 = \text{R}21\,000$.

So the price with VAT is R171 000.

7a) $\frac{6\,000\,000 - 4\,000\,000}{4\,000\,000} \times \frac{100}{1} = 50\%$ profit.

b) $\frac{2\,760 - 3\,000}{2\,760} \times \frac{100}{1} = 8{,}7\%$ discount.

c) 20% of total = R3 000

1% of total = $\frac{3\,000}{20} = \text{R}150$.

100% = R150 × 100 = R15 000.

d) $\frac{14}{100} \times 400 = \text{R}56$. I must pay R456.

e) 3% of total is R10 000

1% of total = $\frac{10\,000}{3}$ = R3 333,33

100% = R3 333,33 × 100 = R333 333.

f) $\frac{300 - 360}{300} \times \frac{100}{1} = 20\%$.

$\frac{450 - 530}{450} \times \frac{100}{1} = 17{,}8\%$

Thandi makes a bigger percentage profit.

Unit 1.7: Simple and compound interest

Grade 7, 8 & 9

1a) A = P(1 + in) = 1 000(1 + 0,05 × 3) = 1 000 (1 + 0,15)
= 1 000 (1,15) = R1 150

b) A = P(1 + i)^n = 1 000 (1 + 0,05)^3 = R1 157,63

c) A = 5 000(1 + 0,1 × 3) = R6 500

d) A = P(1 + i)^n = 5 000 (1 + 0,1)^3 = R6 655

2a) SI = P.n.i = 3 000 × 3 × 0,04 = R360

b) A = P(1 + i)^n = 3 000(1 + 0,04)^3 = R3 374,60

So interest after 3 years is R374,60

c) SI = P.n.i = 6 000 × 3 × 0,12 = R2 160

d) A = P(1 + i)^n = 6 000(1 + 0,12)^3 = R8 429,57

So interest after 3 years is R2 429,57

3. We are looking for P. n = 1 and i = 0,05 SI = R10

SI = P.n.i so 10 = P(1)(0,05)

P = 10 ÷ 0,05 = 200. I invested R200

4. We are looking for P. n = 3 and i = 0,1 SI = R120

SI = P.n.i so P = $\frac{\text{SI}}{n \times i} = \frac{120}{0{,}3} = 400$

So I invested R400.

5. P = R2 000 and A = R4 000 i = 0,05 per month n = ?

A = P(1 + in)

4 000 = 2 000 (1 + 0,05n)

2 = 1 + 0,05n

1 = 0,05n

n = 1 ÷ 0,05 = 20

It will take 20 months to double the amount I borrowed.

Grade 8 & 9

6. P = R4 000 i = 0,15 p.a.; n = 3 years = 3 months; A = ?

a) A = P(1 + in) = 4 000(1 + 0,15 × 3) = R5 800

b) For monthly installments, divide by number of months.
R5 800 ÷ 36 = R161,11 per month.

7. Deposit of 20% = R8 000 × $\frac{20}{100}$ = R1 600

So there is R8 000 – R1 600 = R6 400 left to pay.

So P = R6 400; i = 0,25 p.a. n = 5 years = 60 months

A = 6 400(1 + (0,25)(5))

A = 6 400 (2,25) = R14 400

For monthly installments, divide by number of months.

R14 400 ÷ 60 = R240 per month

Grade 9 only

8a) $A = P(1 + i)^n = 1\,000(1 + 0{,}08)^5 = R1\,469{,}33$

b) $A = P(1 + i)^n = 8\,000(1 + 0{,}08)^5 = R11\,754{,}62$

9a) $A = P(1 + i)^n = 1\,000(1 + 0{,}16)^5 = R2\,100{,}34$

b) $A = P(1 + i)^n = 8\,000(1 + 0{,}16)^5 = R16\,802{,}73$

10. A = R5 000; n = 6 months; i = 10% = 0,1 per month.
$A = P(1 + in)$
$5\,000 = P(1 + 0{,}1 \times 6)$
$5\,000 = P(1{,}6)$
$P = 5\,000 \div 1{,}6 = R3\,125$. I can borrow R3 125.

11. The first 5 years:
P = R3 000; i = 8% = 0,08 p.a;. n = 5 years
$A = P(1 + i)^n = 3\,000(1 + 0{,}08)^5 = R4\,407{,}98$
R4 407,98 + R4 000 = R8 407,98
The next 2 years:
P = R8 407,98; i = 8% = 0,08 p.a;. n = 2 years
$A = P(1 + i)^n = 8\,407{,}98(1 + 0{,}08)^2 = R9\,807{,}07$

12. 5% compound interest is better because you earn interest on the interest of the years before.

13. i) P = R3 000; i = 0,08 p.a.; n = 5 years
$A = P(1 + in) = 3\,000(1 + 0{,}08 \times 5) = R4\,200$
ii) P = R3 000; i = 0,08 p.a.; n = 5 years
$A = P(1 + i)^n = 3\,000(1 + 0{,}07)^5 = R4\,207{,}66$.
This investment gives you more.

Unit 1.8: Simple and compound interest

Grade 7, 8 & 9

1a) $400 \times 1 : 400 \times 3$. I must use 1 200 ml of water.

b) concentrate : total cooldrink = 1 : 4

$\times 2$ (1 : 4 (litres) / ? : 8) $\times 2$

2 : 8

So I need 2 litres of concentrate for 8 litres of cooldrink.

c)

$\div 4$ (1 : 4 (in litres) / ? : 1) $\div 4$

So I need $\frac{1}{4}$ litre of concentrate for 1 litre of cooldrink.

d) I need 10 times more cooldrink than in question c).

$\frac{1}{4} : 1$

$10 \times \frac{1}{4} : 1 \times 10$

So $\frac{1}{4} \times 10 = 2{,}5$ litres of cooldrink

2a) There are 5 + 1 = 6 parts. Each part is R240 ÷ 6 = R40.
1 : 5 = 40 : 200 Nathi gets R40 and Ayanda gets R200.

b) There are 5 + 7 = 12 parts.
Each part is R240 ÷ 12 = R20.
5 : 7 = 100 : 140

c) There are 6 parts. Each part is R240 ÷ 6 = R40.
1 : 2 : 3 = 40 : 80 : 120
Anna gets R40, Tebogo gets R80 and Khotso gets R120.

3a) $\$50 \times 10{,}30 = R515$

b) $R1\,030 \div 10{,}30 = \$100$

c) $R100 \div 10{,}30 = \$9{,}71$

4a) 30 : 2 (biscuits to eggs) / 120 : ?) $\times 4$

$2 \times 4 = 8$ eggs are needed.

b) 30 : 2 (biscuits to eggs) / ? : 7) $\times \frac{7}{2}$

$30 \times \frac{7}{2} = 105$ biscuits can be made.

5a) 400 km ÷ 80 km/h = 5 hours

b) 600 km ÷ 80 km/h = 7,5 hours

c) 4,5 hours × 80 km/h = 360 km

d) 12 minutes = $\frac{12}{60} = \frac{1}{5}$ hour
$\frac{1}{5}$ hour × 80 km/h = 16 km

6a) £10 × 17,20 = R172,00

b) £28 × 17,20 = R481,60

c) R100 ÷ 17,20 = £5,81

d) R1 ÷ 17,20 = £0,058 = £0,06

7a) \$1 = €0.80 $\frac{4}{5} \times \frac{5}{4} = 1$

1 : 0,8 / ? : 1) $\times \frac{5}{4}$

\$1,25 = €1

b) \$1 = R12 and \$1 = €0.80 so R12 = €0.80
So R1 = $\frac{0{,}8}{12} = €0{,}067$
So R100 = $0{,}0667 \times 100$ = €6,67

8a) 1 person for 30 days, so 10 people for 3 days.

b) 5 days × 6 people = 30, so there is enough food for 6 people for 5 days.

9a) 4 kg × R35/kg = R140

b) ½ kg × R35/kg = R17,50

c) 0,4 kg × R35/kg = R14,00

d) 0,6 kg × R35/kg = R21,00

10a) R3,50 for a 200 ml can: R3,50 × 5 = R17,50 per litre.
R4,50 for a 340 ml can: R4,50 × $\frac{1\,000}{340}$ = R13,23 per litre.
R6,90 for a 500 ml bottle: R6,90 × 2 = R13,80 per litre.
R12 for a 2 litre bottle: R6 per litre

b) The 2 litre bottle is the cheapest at R6 per litre.

11. Andile: 532 ÷ 5 = 106,4 km/h,
Bongani: 392 ÷ 3 = 130,7 km/h
Chris: 200 ÷ 2 = 100 km/h. Bongani is the fastest.

12. 1 : 30 000 means 1 cm on the map represents 30 000 cm on the ground.
So 5 cm represents 150 000 cm.
150 000 cm = 1 500 metres = 1,5 km

13. 8 cakes cost R92, so 1 cake costs 92 ÷ 8 = 11,5.
10 cakes cost 11,5 × 10 = R115,00.

Grade 9 only

14a) x and y are directly proportional because $3x = y$

b) x and y are indirectly proportional because $x \times y = 36$

c) x and y are not in proportion.

d) x and y are directly proportional because $1{,}2x = y$

15a) $5 \times 2 = 10$, so $12{,}5 \times 2 = p$ so $p = 25$ and
$q \times 2 = 2$ so $q = 1$

x	5	12,5	q
y	10	p	2

b) $5 \times 10 = 50$, so $12{,}5 \times p = 50$, so $p = \frac{50}{12{,}5} = 4$
$q \times 2 = 50$, so $q = 25$

Unit 1.9: Integers

Grade 7, 8 & 9

1a)	–2	b)	–7	c)	–11	d)	–23	e)	–22
2a)	–7	b)	– 4	c)	2	d)	–27	e)	–18
3a)	9	b)	– 4	c)	14	d)	12	e)	–4
4a)	6	b)	16	c)	35	d)	51	e)	3
5a)	285	b)	–78	c)	111	d)	–41	e)	– 46
6a)	5	b)	0	c)	8	d)	–32		

7a) 5 + 7 = 12 b) – 7 + (– 5) = –12
c) 7 – (–7) = 14 d) –7 – (7) = –14

8. 7 – 9 + 18 = 16°C. 16 – 7 = 9°C. It was 9°C warmer.

9. It is not correct. If you add two negative numbers, your answer is smaller.
Example: – 7 + (– 8) = –15, but – 7 – (– 8) = 1 and 1 > –15

Grade 8 & 9

10a) –18 b) –35 c) 40 d) –14 e) 48
11a) –6 b) –4 c) 7 d) 4 e) 8
12a) 8 + 3(–2) = 2
b) 24 ÷ (–3) + 3 × (–2) = –8 –6 = –14
c) (23 + 4) ÷ 9 – 6 = 27 ÷ 9 – 6 = 3 – 6 = –3
13a) $\frac{-12}{9} \times \frac{6}{4} = \frac{-3}{3} \times \frac{2}{1} = -2$
b) $\frac{-15}{-5} + 3(7-9) = 3 + 3(-2) = 3 - 6 = -3$
c) $\frac{9+6}{-6} - \frac{1}{2} = \frac{15}{-6} - \frac{1}{2} = \frac{15+3}{-6} = \frac{18}{-6} = -3$
14a) –3 × –3 = 9 b) $-3^2 = -3 \times 3 = -9$
c) $-3^2 - (-3)^2 = -9 - 3 = -12$

15a) **15** + (–3) = 12 b) 15 + **(–9)** = 6
c) 15 – **9** = 6 d) **–8** – (–7) = –1
e) **4**– (–5) = 9 f) 235 + **(-46)** = 189
g) **–136**– (–72) = –64 h) 145 – **9** = 136
i) **35** + (–13) = 22 j) **–3** × (–5) = 15
k) 2 × **5** = 10 l) 7 × **3** = 21
m) **–3** × 4 = –12 n) –120 ÷ **–6** = 20
p) **–7** × (–12) = 84

16a) 2(−2)(7) = −28 b) 7 –(−2) = 9
c) −2 + 7 –(−2) = 7 d) (−2 – 7) – 7 = −16
e) $10(-1)^2 \div -2 = 10 \div -2 = -5$ f) $(7)^2 - (-2)(7) = 63$
g) ½ (7)(–2) –(–1) = –7 + 1 = –6
h) 3(–2) + 2(7) = –6 + 14 = 8
i) $[(-2)(7)(-1) - (-2)^2(7)^3(-1)^4]^0 = 1$

17. Let the numbers be x and y.
So $x + y = -6$ and $xy = -16$.
One method is to test different numbers.
Example: 1 and –16; 2 and –8; 4 and –4 work for $xy = -16$.
Of these, 2 and –8 also works for $x + y = -6$.
So $x = 2$ and $y = -8$ is a solution.
Note that $x = -2$ and $y = 8$ doesn't work.

18. Let the numbers be x and y.
So $x + y = -17$ and $xy = 72$.
2 and 36, 3 and 24, 6 and 12, 9 and 8 give a product of 72.
9 and 8 give a sum of 17, so –9 + (–8) = –17.
So $x = -9$ and $y = -8$, or $x = -8$ and $y = -9$.

19. Let the numbers be x and y, so that $\frac{x}{y} = 3$ and $xy = 12$.
1 and 12, 2 and 6, 3 and 4 all make a product of 12.
$\frac{6}{2} = 3$, so $x = 6$ and $y = 2$ is a solution.
$x = -6$ and $y = -2$ is also a solution.

Unit 1.10: Exponents

Grade 7, 8 & 9

1a) 3 + 36 ÷ 2 = 3 + 18 = 21
b) $27 \div 3^2 = 27 \div 9 = 3$
c) $\sqrt{16} \times 2 = 4 \times 2 = 8$
d) $3 + 3 \times 4 = 3 + 12 = 15$
e) $(4 - 1 + 1) \times 5 = 4 \times 5 = 20$
f) $2^3 \div 4 = 8 \div 4 = 2$
2a) $3^7 = 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3$
b) $6^2.7^4 = 6 \times 6 \times 7 \times 7 \times 7 \times 7$
c) $\left(\frac{1}{2}\right)^5 = \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2}$
3a) 3^4 b) $4^3.6^4$ c) $\left(\frac{2}{3}\right)^5$ d) $(0{,}1)^4$

4. Learner A is correct. Using BEDMAS, we need to work out the exponent first, then the multiplication and then add. Learner B multiplies before working out the exponent and gets the answer wrong.

5. B is a better offer.
2, 4, 8, 16 … = 2^1, 2^2, 2^3, 2^4…
So the amount on day 30 will be 2^{30} = R10 737 418,24

Grade 8 & 9

6a) $-4 + (-3)2 = -4 + 9 = 5$
b) $1 - \sqrt{25} \times 3 + 3^2 = 1 - 5 \times 3 + 9$
$= 1 - 15 + 9 = -5$
c) $2 \times 4 \div (-4) = -2$
d) $-125 \div 5 = -5$
7a) $(-4)^6 = -4 \times -4 \times -4 \times -4 \times -4 \times -4$
b) $(-2)^7.7^2 = -2 \times -2 \times -2 \times -2 \times -2 \times -2 \times -2 \times 7 \times 7$
c) $x^4y^3 = x.x.x.x.y.y.y$
8a) 5^6 b) $(-2)^3$
9 a) 1 260 000 = $1{,}26 \times 10^6$
b) $2{,}32 \times 10^{12}$
c) $103{,}2 = 1{,}032 \times 10^2$
d) $216{,}67 \times 10^4 = 2{,}1667 \times 10^6$
10a) $6a^5$ b) $4a^6$ c) $4x^6$ d) $\frac{a^2}{4m}$
e) $\frac{2(6xy^3)^2}{3y^3} = \frac{2(36x^2y^6)}{3y^3} = 24x^2y^3$
11a) x^{2n+5} b) $9x^6y^2$
c) $\frac{2xy^2}{16x^4y^6} \times 8x^4y^5 = \frac{1}{8x^3y^4} \times 8x^4y^5 = xy$
d) $\frac{(4p^2q)q^2}{1} = 4p^2q^3$ e) 1
f) $\frac{a^4m^6.\ am^4}{a^3m^4} = a^2m^6$

12a) x^4y^5 b) $a^5b^5c^4$

13a) $7{,}86 \times 10^{-8}$ b) 6×10^{-2}

c) $2{,}88 \times 10^{-10}$ d) $3{,}0 \times 10^{-6}$

14a) $27x^{-3}$ b) $\frac{-3a^0}{a^2} = \frac{-3}{a^2}$

c) $\left(\frac{4}{5}\right)^{-2} = \left(\frac{5}{4}\right)^2 = \frac{25}{16}$ d) $\frac{4a^3b^5}{(2ab^3)^2} = \frac{4a^3b^5}{4a^2b^6} = \frac{a}{b}$

15. 1 year = 365 days = $365 \times 24 \times 60 \times 60$ seconds.

speed = $\frac{\text{distance}}{\text{time}}$ so distance = $\text{speed} \times \text{time}$

distance = $299\,800 \times 31\,536\,000$

$= 9{,}454 \times 10^{12}$ km/s

16. 1 micrometre = 0,000001 m

so 6 micrometres = 0,000006 m = $0{,}6 \times 10^{-5}$

17. a) 1 nm = 10^{-9} m So 100 nm = 10^{-7}m

b) 1 cm = 10^{-2} m and $\frac{10^{-2}}{10^{-7}} = \frac{10^7}{10^2} = 10^5$

So 10^5viruses can fit along a 1 cm line.

18a) $2^x = 2^3$ so $x = 3$ b) $3^x = \frac{1}{3^4} = 3^{-4}$ so $x = -4$

c) $6^{x+1} = 6^0$ so $x + 1 = 0$ and $x = -1$

d) $2^x 2^{3x} = 2^4$ so $4x = 4$ and $x = 1$

ALGEBRA

Unit 2.1: Algebraic expressions

Grade 7, 8 & 9

1.	variable	coefficient	constant
a) $5x - 8$	x	5	–8
b) $2a + 9$	a	2	9
c) $6 - 3b$	b	–3	6
d) $2x + 8$	x	2	8

2a) $x + 5$ b) $x - 5$

c) $2x$ d) $\frac{1}{2}x$

3a) $24d$ b) $12x$

c) $0{,}50m + 10$

d) One side of square is $\frac{p}{4}$, so area = $\left(\frac{p}{4}\right)^2 = \frac{p^2}{16}$

4a) $2(2)^2 + 7 = 15$ b) $2(2)^3 - 7 = 9$

c) $(2)(7) - 3(2) = 8$ d) $(2) - 3(2)(7) = -40$

e) $\frac{7}{3} + 2 = 4\frac{1}{3}$ f) $\frac{2}{3} + 7 = 7\frac{2}{3}$

Grade 8 and 9

5a) i) 3 ii) –1 b) i) –1 ii) ½

c) i) 1 ii) 0,2

6a) 4 terms b) 2 terms c) 1 term

d) 2 terms e) 1 term

7a) $2p + p^2$ b) $8x^2 + 2x + 4$

c) $xy^2 + xy - 2y^2$

d) $5xy$ e) $p^3q + 2pq + p^2q$

f) $a^3 + 2a^2$

8a) $(-1)^3 = -1$

b) $3(-1)^3 - 6(3) = -21$

c) $3(-1)(3)^2 = -27$

d) $(3.-1.3)^2 = (-9)^2 = 81$

9.

		$5a + 28b + 13c$		
		$5a + 18b + 3c$	$10b + 10c$	
		$5a + 10b$	$8b + 3c$	$2b + 7c$
	$5a + 4b$	$6b$	$2b + 3c$	$4c$
$5a$	$4b$	$2b$	$3c$	c

Unit 2.2: Calculating with algebraic expressions

Grade 8 and 9

1a) $-x^2 - 7x - 4$ b) $-2m^2n + 6mn + mn^2$

c) $2b^6 + b^2 + b - 3$ d) $-6pq + 2p + 2q$

e) $-2a^4b^6c^3$ f) $2y^3 + 8y^2$

g) $2m^3 + 2m^2$ h) $-m^3n - 3m^2n - 4mn^2$

i) $12x + 8 + 5x + 5$

j) $2x^2y + 3xy^2 + 5x^2y - 5xy^2 = 7x^2y - 2xy^2$

k) $10x^2 - 5x^2 - 2x + 3x - 3 = 5x^2 + x - 3$

l) $-a + 3 - 3 + a = 0$

m) $-2x^2 - 2xy + 3x^2 - 3xy = x^2 - 5xy$

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

o) $\frac{xy^2}{3}$ p) $\frac{5a^3b^2c}{15a^2b} - \frac{3a^2b}{15a^2b} = \frac{abc}{3} - \frac{1}{5}$

q) $x^2 - 2y + 3$ r) $7p^8$

s) x^3y t) $\sqrt{16a^4b^8} = 4a^2b^4$

u) $-125x$

v) $\frac{8a^2b}{2ab} + \frac{14ab^2}{2ab} + \frac{3a^2b^3}{2ab} = 4a + 7b + \frac{3ab^2}{2}$

2. Area $\Delta = \frac{1}{2}.b.h = \frac{1}{2}.2x(x+1) = x^2 + x$

Grade 9

3a) $2a^2 + 9a + 4$

b) $2x^2 - 5xy - 3y^2$

c) $3m^2 + 3m + 3mn + 3n$

d) $y^2 + 6y + 9$

e) $b^2 - 4bc + 4c^2$

f) $x^2 - 9$

g) $4a^2 - 9b^2$

h) $\frac{1}{2}x^2 + 5x - 2x - 12 = \frac{1}{2}x^2 + 3x - 12$

i) $2(x^2 - 25) = 2x^2 - 50$

j) $-(x^2 + 2x - 15) = -x^2 - 2x + 15$

k) $49 - 42x + 9x^2$

l) $(x^2 + x - 6) - (x^2 + 3x + 2) = -2x - 8$

m) $(3x^2 + x - 4) - (x^2 + 2x + 1) = 2x^2 - x - 5$

n) $-0{,}1(10x^2 + 320x + 600) = -1x^2 - 32x - 60$

4. One of the factors, $x - x = 0$, so the answer to the whole product is 0.

Unit 2.3: Factorising algebraic expressions

Grade 9

1. $3(x - 3)$
2. $a(3a^3 - 4)$
3. $11ax(a - 2ax + 5)$
4. $(p - 3q)(m - 4)$
5. $a(b - c)$
6. $2a(a - 3b)$
7. $x^2(x - 1)$
8. $3p^2(1 + 2p + 3p^4)$

9. $(2x+5)(4x-1)$
10. $(1+4a)(1-4a)$
11. $(3x+2)(x+5)$
12. $2(x-y)-3(x-y)=-(x-y)=y-x$
13. $-7(2a-b)+3(2a-b)$
    $=-4(2a-b)=4(b-2a)$
14. $(x+8)(x-3)$
15. $(x+2)(x+4)$
16. $5(x^2-6x+9)=5(x-3)(x-3)=\ 5(x-3)^2$
17. $\left(\frac{1}{2}x+2\right)(x+2)$
18. $2(y^2+6y+9)=2(y+3)(y+3)=\ 2(y+3)^2$
19. $2(x^2+4x-21)=2(x+7)(x-3)$
20. $(y^2+1)^2$
21. $(5k+3m^2)(5k-3m^2)$
22. $(x+7)(x+2)$
23. $(x-8)(x-6)$
24. $(x-2)(x+1)$
25. $(x+9)(x-5)$
26. $2(x^2-9y^2)=2(x-3y)(x+3y)$
27. $4x(x^2+7x-8)=4x(x-1)(x+8)$
28. $5(x^2-y^2)=5(x-y)(x+y)$
29. $2y(16x^2-25y^2)=2y(4x-5y)(4x+5y)$
30. $b(x^2-y^2)=b(x-y)(x+y)$
31. $\left(7y^3-\frac{1}{3}x\right)\left(7y^3+\frac{1}{3}x\right)$
32. $x^2+2x+1=(x+1)(x+1)=(x+1)^2$

So the sides of the square are all $x+1$ units long.

33. $\frac{2m^2+4m}{m^2-4}=\frac{2m(m+2)}{(m-2)(m+2)}=\frac{2m}{m-2}$
34. $\frac{a(a+1)}{a+1}=a$
35. $\frac{(x+5)(x-5)}{(x-5)(x+2)}=\ \frac{x+5}{x+2}$
36. $\frac{x^2+2x+1}{x^2-1}=\frac{(x+1)(x+1)}{(x+1)(x-1)}=\frac{(x+1)}{(x-1)}$
37. $\frac{a(a-1)}{(a-1)(a-1)}\times\frac{3(a-1)}{a}=3$
38. $\frac{2(x^2+3x+2)}{x^2+5x+6}=\frac{2(x+2)(x+1)}{(x+2)(x+3)}=\frac{2(x+1)}{x+3}=\frac{2x+2}{x+3}$
39. $\frac{x^4-81x^2}{2x}\times\frac{6}{x^2-9x}=\frac{x^2(x^2-81)}{2x}\times\frac{6}{x(x-9)}$
    $=\frac{x^2(x+9)(x-9)}{2x}\times\frac{6}{x(x-9)}=3(x+9)=3x+27$
40. $\frac{x^4-1}{x^2+1}=\frac{(x^2+1)(x^2-1)}{x^2+1}=x^2-1$
    $=(x-1)(x+1)=x^2-1$

Unit 2.4: Algebraic equations

Grade 7, 8 & 9

1. The smaller number be x. So the other number is x + 2.
   x + (x + 2) = 82
   2x + 2 = 82
   2x = 80
   x = 40

The smaller number is 40 and the other is 42.

2. $4y+5=25$ (rand)
   $4y=20$
   $y=5$ So a pencil costs R5.
3. $5(x+4)=60$ pieces
   $5x=60-20$
   $5x=40$
   $x=8$

The consumer studies class bakes 8 apple pies.

4. Sihle's number: 6x
   John's number: 3x + 9
   $6x=3x+9$
   $3x=9$ so x = 3 Jabulani's number is 3.

5a) $y=2 \quad z=4$
b) $m=4$
c) $2z=8$ so $z=4$
d) $2a=2$ so $a=1$
e) $2r=10$ so $r=5$
f) $x=4-\frac{1}{2}=3\frac{1}{2}=\frac{7}{2}$
g) $p=8\times3=24$
h) $x=3\times2=6$
i) $y=3\div0{,}1=3\times10=30$
j) $\frac{1}{3}x=2$ so $x=6$
k) $x=\frac{-6}{-2}=3$
l) $x=\frac{10}{-2}=-5$

6. $(3)^2+2(3)=9+6=15$
   So x = 3 is a solution of the equation.
7. $(4)^2+\sqrt{4}=16+2=18.$
   So x = 4 is not a solution of the equation.
8. Let Thando's number be x.
   Ayanda's number: 8x
   Zelethu's number: 6x + 14
   $8x=6x+14$
   $2x=14$ so x = 7 Thando's number is 7.

Grade 8 & 9

9a) $\frac{4}{3}\times\frac{3x}{4}=2\times\frac{4}{3}$ so $x=\frac{8}{3}$
b) $-x=1$ so x = –1
c) $3y=12$ so $y=4$
d) $3a-6=6$ so $3a=12$ and a = 4
e) $3b=2b-2$
   so $b=-2$
f) $\frac{y}{3}\times6-\frac{y}{2}\times6=4\times6$
   $2y-3y=24$
   $-y=24$ and $y=-24$
g) $z-1=12$
   $z=13$
h) $\frac{3}{x}=6$ so $3=6x$ $x=\frac{3}{6}=\frac{1}{2}$
i) $3x-15-2x+2=7$
   $x-13=7$ so $x=20$
j) $5x+5-x-2=-x+3$
   $5x=0$ so x = 0

k) $1-x+2x-1-4=0$
   $1-x+2x-1-4=0$
   $x-4=0$ so $x=4$

l) $3x + 3 - 2x - 6 = 5$
$x - 3 = 5$ so $x = 8$

m) $6x - 3x = -9 - 2$
$3x = -11$ so $x = \frac{-11}{3}$

n) $5x + 10 - 2x + 18 = 3x + 6 + x$
$3x + 28 = 4x + 6$
$-x = -22$ so $x = 22$

o) $12\times\frac{x}{4} + 12\times\frac{x}{3} = 7\times12$
$3x + 4x = 84$
$7x = 84$ so $x = 12$

10. Let the number of biscuits be x.
$2x + 8 = 20$
$2x = 12$ so $x = 6$ I buy 6 biscuits.

11. Let the number be x.
$x - 1 = (x + 3)\times2$
$x - 1 = 2x + 6$
$x = -7$

12. $(x + 1)\times3 = 2x - 3$
$3x + 3 = 2x - 3$
$x = -6$

13. Let the length of the field be x metres.
Then the breadth is (x – 10) metres.
Perimeter = 100 = 2x + 2(x – 10)
100 = 2x + 2x – 20
120 = 4x
30 = x The length of the field is 30 metres.

14. Let x be the kilometres run on Monday.
Then on Wednesday, I run (x + 4) km and on Saturday, I run 2x km. So x + (x + 4) + 2x = 40.
4x + 4 = 40 So x = 9 km. I ran 9 km on Monday.

15. $3(x + 1) = 2x - 3$
$3x + 3 = 2x - 3$
$x = -6$

Grade 9

16a) Multiply through by 45
$15a - 9a = 5$
$6a = 5$
$a = \frac{5}{6}$

b) $\frac{x}{5} - \frac{x}{3} = -8$
Multiply through by 15
$3x - 5x = -8\times15$
$-2x = -120$
$x = 60$

c) Multiply through by 30
$3y + 10(y - 6) = 270$
$3y + 10y - 60 = 270$
$13y = 330$
$y = \frac{330}{13} = 25\frac{5}{13}$

d) Multiply through by 36
$9b + 4(b - 3) = 324$
$9b + 4b - 12 = 324$
$13b = 312$
$b = 24$

e) $\frac{3a}{7} - 7 = \frac{a-2}{8}$
Multiply through by 56
$24a - 392 = 7(a - 2)$
$24a - 392 = 7a - 14$
$17a = 378$
$a = 22\ \frac{4}{378}$

f) $x^2 = 64$
$(x - 8)(x + 8) = 64$
$x = 8$ or $x = -8$

g) $x = 0\ or\ x - 3 = 0$
$x = 0\ or\ x = 3$

h) $(a + 4)(a - 4) = 0$
$a = -4\ or\ a = 4$

i) $b^2 - 3b - 40 = 0$
$(b - 8)(b + 5) = 0$
$b = 8$ or $b = -5$

j) $2y(y + 3) = 0$
$y = 0$ or $y = -3$

k) $(x + 2)(x + 5) = 0$
$x = -2$ or $x = -5$

l) $k^2 + 4k + 4 = 0$
$(k + 2)(k + 2) = 0$
$k = -2$

m) $3k^2 - 33k + 72 = 0$
$3(k^2 - 11k + 24) = 0$
$3(k - 8)(k - 3) = 0$
$k = 8$ or $k = 3$

n) $a^2 + 20a + 100 = 0$
$(a + 10)(a + 10) = 0$
$a = -10$

17a) $9x^2 + 36x + 35 = 24x + 31$
$9x^2 + 12x + 4 = 0$
$(3x + 2)(3x + 2) = 0$
$3x = -2$
$x = \frac{-2}{3}$

b) $\frac{p+2}{p-6} = \frac{p+9}{p+5}$
$(p + 2)(p + 5) = (p - 6)(p + 9)$
$p^2 + 7p + 10 = p^2 + 3p - 54$
$4p - 44 = 0$
$4(p - 11) = 0$
$p = 11$

c) $(x - 5)(x - 5) = (x - 9)(x - 10)$
$x^2 - 10x + 25 = x^2 - 19x + 90$
$9x - 115 = 0$
$9x = 115$
$x = \frac{115}{9}$

d) $x^2 - 2x - 3 = 0$
$(x - 3)(x + 1) = 0$
$x = 3$ or $x = -1$

e) $5x^2 - 10x + 5 = 0$
$5(x^2 - 2x + 1) = 0$
$5(x - 1)(x - 1) = 0$
$x = 1$

f) $x^2 - x - 6 = 0$
$(x - 3)(x + 2) = 0$
$x = 3$ or $x = -2$

g) $3(x - 2) - 5(2x + 1) = -30$
$3x - 6 - 10x - 5 = -30$
$-7x + 19 = 0$
$-7x = -19$
$x = \frac{19}{7}$

h) Multiply through by 6
$10(x + 1) - 6x = 3(x - 1)$
$10x + 10 - 6x = 3x - 3$
$x = -13$

i) Multiply through by 4
$2(x - 1) - 12x = 4x - 4$
$2x - 2 - 12x = 4x - 4$
$-14x = -2$
$x = 7$

j) $\frac{(x+1)(x+1)}{3(x+1)} + \frac{2x+1}{5} = 1$

Multiply through by 15(x + 1)

$5(x+1)(x+1) + 3(x+1)(2x+1) = 15(x+1)$

$5x^2 + 10x + 5 + 6x^2 + 9x + 3 = 15x + 15$

$11x^2 + 19x + 8 = 15x + 15$

$11x^2 + 4x - 7 = 0$

$(11x - 7)(x + 1) = 0$

$x = \frac{7}{11}$ or $x = -1$

18. Let the number be x. The other number is x + 5.

$x(x+5) = 36$

$x^2 + 5x - 36 = 0$

$(x+9)(x+4) = 0$

$x = -9$ *or* $x = -4$

Unit 2.5: Patterns and algebra

Grade 7, 8 & 9

1a) 1; 4; 7; 10; **13; 16; 19.**

Start at 1 and add 3 for each new term.

$T_n = 3n - 2$

b) 20; 15; 10; 5; 0; –5; –10.

Start at 20 and subtract 5 for each new term.

$T_n = -5n + 25$

c) …; 48; 96; 192 Start with 3 and multiply by 2

d) ... 50; 72; 98 Square the position and multiply by 2

e) ... 27; 9; 3 Start with 2 187 and divide by 3

2a) 4 tiles c) The 10th pattern number

b) 24 tiles d) $T_n = 4n$

3a)

Number of cars (n)	1	2	3	4	5
Number of wheels T_n	4	8	**12**	**16**	**20**

b) Multiply number of cars by 4.

c) 400 wheels

d) $T_n = 4n$

4a)

rows	b) sum of row
1	1
121	4
12321	9
1 234321	16
1 23454321	25
1 2345654321	36
1 234567654321	49
1 23456787654321	64

c) The sum of each row is a square number.

d) n^2 where n is the position number of the row.

e) for 40th row, $n^2 = 40 \times 40 = 1\,600$

5a)

Tins at base of display (n)	1	2	3	4	5	6
Tins in step of display T_n	1	3	1+2+3 =6	1+2+3+4 =10	15	21

b) Start with one tin and add a row each time. The added row has one more tin each time.

Grade 8 & 9

6a) 5; 9; 13; 17; 21; 25.

b) $T_n = 4n + 1$

. c) 12 pentagons: 4(12) + 1 = 49 matches

93 matches: 93 = 4n + 1

92 = 4n so n = 23

93 matches make 23 pentagons

7. Pattern is 1; 5; 9; …

General rule is $T_n = 4n - 3$

$T_n = 241 = 4n - 3$

$244 = 4n$ so n = 61

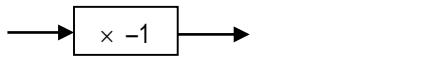
Unit 2.6: Functions

Grade 7, 8 & 9

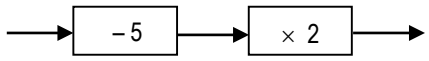
1a) The output number must be double the input number.

b) The output number must be double the input number, then 1 must be subtracted.

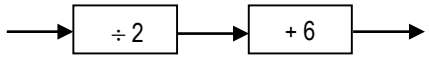
2a)



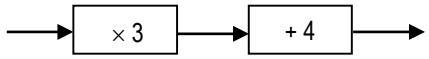
b)



c)



d)



3. Some examples:

a) Input: 6 Output: –6

b) Input: 6 Output: 2

c) Input: 6 Output: 9

d) Input: 6 Output: 22

4a) $y = x + 6$ b) $y = -4x - 2$

c) $y = \frac{x}{2} + 3$ d) $y = \frac{1}{2}x$

e) $y = -4x + 6$ f) $y = \frac{-2x}{3}$

g) $y = 5x - 8$ h) $y = x$

5)

	x	–2	–1	0	1	2
a)	y	4	5	6	7	8
b)	y	6	2	–2	–6	–10
c)	y	2	$2\frac{1}{2}$	3	$3\frac{1}{2}$	4
d)	y	–1	$-\frac{1}{2}$	0	$\frac{1}{2}$	1
e)	y	14	10	6	2	–2
f)	y	$\frac{4}{3}$	$\frac{2}{3}$	0	$-\frac{2}{3}$	$-\frac{4}{3}$
g)	y	–18	–13	–8	–3	2
h)	y	–2	–1	0	1	2

6)

	x	–1	0	1
a)	$y = x + 1$	0	1	2
b)	$y = 2x - 3$	–5	–3	–1
c)	$y = \frac{1}{2}x - 1$	$-1\frac{1}{2}$	–1	$-\frac{1}{2}$
d)	$y = -x + 1$	2	1	0
e)	$y = -2x - 3$	–1	–3	–5
f)	$y = -\frac{1}{2}x - 1$	$-\frac{1}{2}$	–1	$-\frac{3}{2}$

7a) Missing input value: 4 Missing output value: 1

b) Missing rule: × 3 + 2

Grade 8 & 9

8.

x	1	2	3	4	6	7	8	9	10	11
y	**11**	**10**	**9**	**8**	**6**	**5**	**4**	**3**	**2**	**1**

$2(x + y) = 24$ so $x + y = 12$. When $y = 5$, $x = 7$.

9.

Number of sides (n)	3	4	5	6	10
angle size (b)	60	90	108	120	144

$b = 180° - \frac{360°}{3} = 60°$

b) 20 sides: $180° - \frac{360°}{20} = 162°$

120 sides: $180° - \frac{360°}{120} = 177°$

c) Angles of 150°: $180° - \frac{360°}{n} = 150°$

$30° = \frac{360°}{n}$ so $30n = 360$ so $n = 12$

10a) y = 1,14(38) = R43,32

b) y = 1,14(50) = R57,00

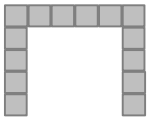
c)

x rands	1	2	3	4
y rands	1,14	2,28	3,42	4,56

5	6	7	8	9
5,70	6,84	7,98	9,12	10,26

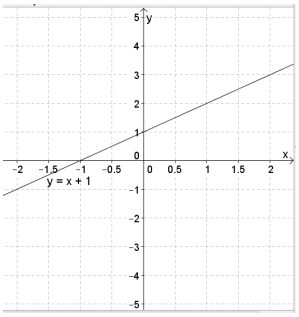
d) Using pattern from c), then R10 will be R11,40 with VAT included. So the price was R10 before VAT was added.

e) Using pattern from c), R3 will be R3,42 with VAT, so R300 will be R3,42 x 100 = R342.
So the price was R300 before VAT was added.

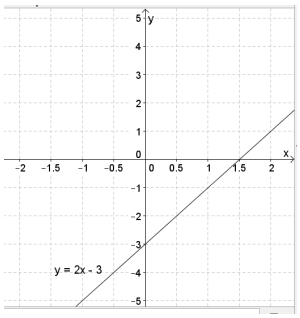
11a) 

b) The rule is $3x + 2$
Check: 3(1) + 2 = 5
3(17) + 2 = 53

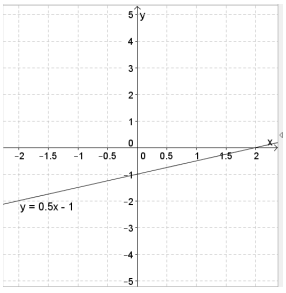
12a)



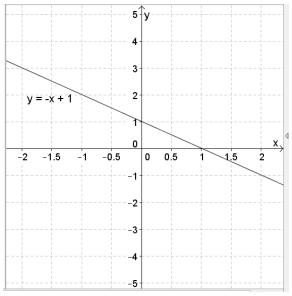
b)



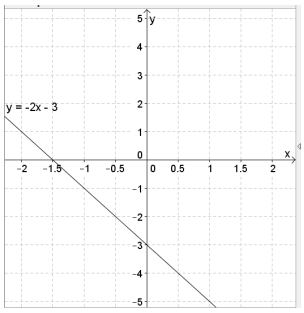
c)



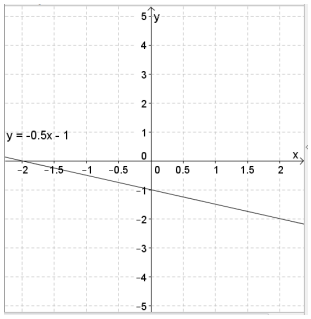
d)



e)



f)



Unit 2.7: Graphs

Grade 7, 8 & 9

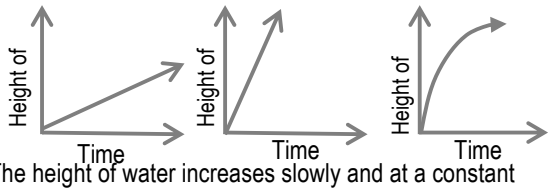
1a) linear b) non-linear c) non-linear

2a) decreasing b) constant c) decreasing
d) increasing e) increasing f) constant

3a) Learner B (Bob) b) Learner D (Dineo)
c) Anna studied for 2 hours and she got 5 out of 10 marks.
d) Bob (10 hours) and Dineo (6 hours)
e) Anna, Cam and Bob

4. All three athletes completed the 400 m race. B was the fastest and C was the slowest. Athlete A started fast but decreased his pace gradually. Athlete B started slowly and increased his pace gradually. Athlete C started well, but stopped after a few seconds. When he started again, he kept increasing his pace, but his time was still slower than the other two athletes.

5.

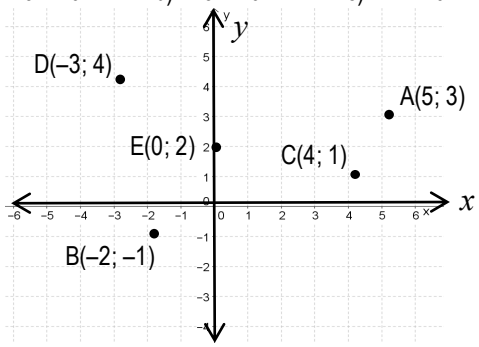


A: The height of water increases slowly and at a constant rate. **B:** The height of water increases quickly and at a constant rate. **C:** The height of water increases quickly and then slows down.

Grade 8 & 9

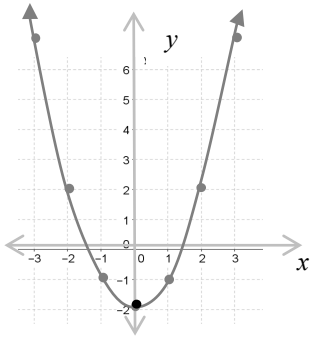
6a) maximum b) maximum c) minimum

7.



8a)

x	–3	–2	–1	0	1	2	3
$y = x^2 - 2$	7	2	–1	–2	–1	2	7

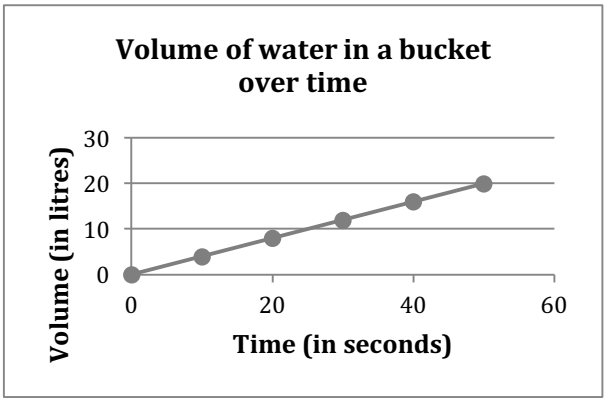


d) The minimum value is –2 at (0; –2).

Unit 2.8: Straight line graphs

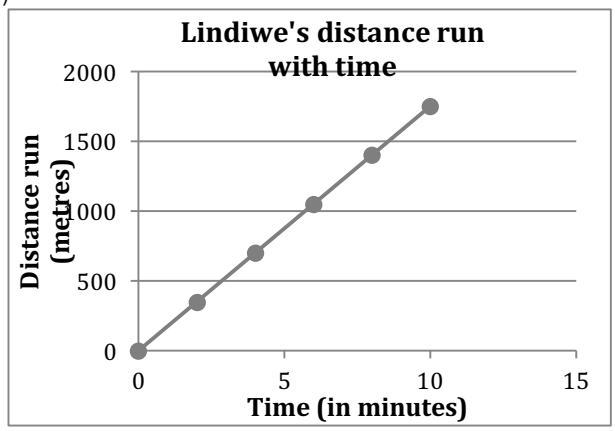
Grade 7, 8 & 9

1a)



b) No, the time can't be less than 0 to extend the graph to the left. Once the bucket has reached 20 litres it is full, so it can't be extended to the right either.

2a)



b) No. It is difficult to keep the same running rate over a longer time.

c) As Lindiwe slows down, the graph will be less steep.

3a) $\frac{3-1}{5-1}=\frac{2}{4}=\frac{1}{2}$ b) $\frac{3-2}{5-0}=\frac{1}{5}$

c) $\frac{2-(-2)}{-1-(-5)}=\frac{4}{4}=1$ d) $\frac{0-3}{1-(-2)}=\frac{-3}{3}=-1$

4a) Using (–1; 0) and (3; 8) $\frac{8-0}{3-(-1)}=\frac{8}{4}=2$

b) Using (2; 5) and (3; 15) $\frac{15-5}{3-2}=\frac{10}{1}=10$

5a) $x+y-2=0$
$y=-x+2$
$m=-1$ and $c=2$

b) $y-x+2=0$
$y=x-2$
$m=1$ and $c=-2$

c) $3x-5y=-15$
$-5y=-3x-15$
$y=\frac{-3x}{-5}+\frac{15}{5}$

d) $2y-2=-2x$
$2y=-2x+2$
$y=-x+1$

$y=\frac{3x}{5}+3$

$m=\frac{3}{5}$ and $c=3$ $m=-1$ and $c=1$

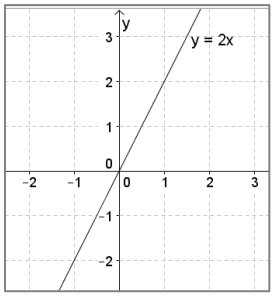
6a)

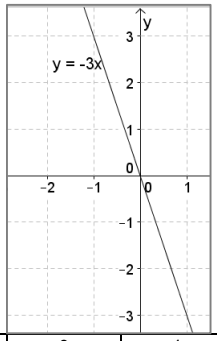
x	–1	0	1
$y = 2x$	–2	0	2

b)

x	–1	0	1
$y = –3x$	3	0	–3

Graphs: a) b)





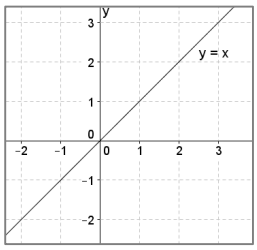
c)

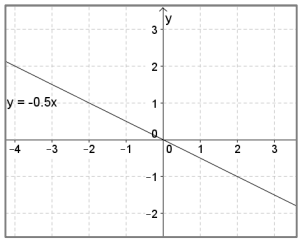
x	–1	0	1
$y = x$	–1	0	1

d)

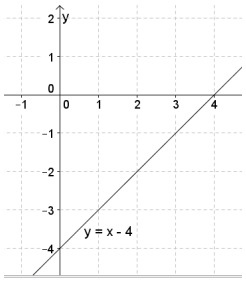
x	–1	0	1
$y=-\frac{1}{2}x$	$\frac{1}{2}$	0	$-\frac{1}{2}$

Graphs: c) d)

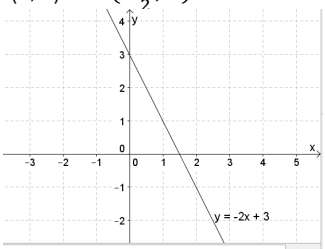




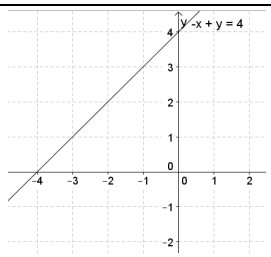
7a) $y=x-4$
When x = 0, y = –4
When y = 0, x = 4
(0; –4) and (0; 4)



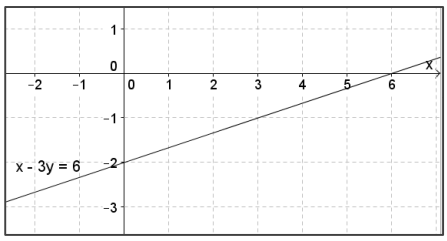
b) $y=-2x+3$
When x = 0, y = 3
When y = 0,
$0=-2x+3$
$2x=3$ and $x=\frac{3}{2}$
(0; 3) and $(1\frac{1}{2};0)$



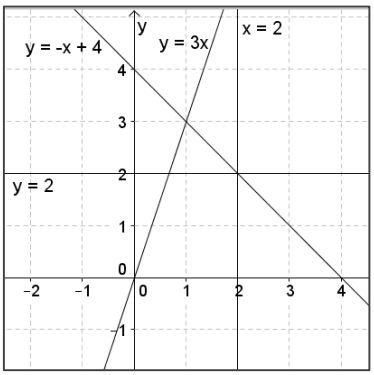
c) $2y=2x+8$
When x = 0,
$2y=8$
So y = 4
When y = 0
x = –4
(0; 4) and (–4; 0)



d) $2x - 6y = 12$
When $x = 0$, $y = -2$ (0; –2)
When $y = 0$, $x = 6$ (0; 6)



8.



9a) $y = mx + c$
$m = \frac{2}{1} = 2$ and $c = -2$
So $y = 2x - 2$
b) $m = \frac{4}{-3}$ and $c = -4$
So $y = -\frac{4}{3}x - 4$
c) m is undefined and there is no y-intercept.
The equation of the line is $x = 2$.
d) $m = 6$ and $c = 3$
So $y = 6x + 3$
e) $m = 0$.
The equation of the line is $y = -3$
f) $m = \frac{-2-1}{5-0} = -\frac{3}{5}$ and $c = 1$
So $y = -\frac{3}{5}x + 1$

10a) These points lie on a straight line.
$m = \frac{7-5}{1-0} = 2$ and $c = 5$
So $y = 2x + 5$
b) These points can't lie on a straight line.
Each pair of points give different gradients.
c) These points can't lie on a straight line.
Each pair of points give different gradients.
d) These points lie on a straight line.
$m = \frac{6-9}{0-(-1)} = \frac{3-6}{1-0} = -3$ and $c = 6$
So $y = -3x + 6$

11a) From the graph, when $y = 8$, $x = 2$
b) $3x + 2 = 8$, so $3x = 6$ and $x = 2$
c) At A, $y = 0$, so $3x + 2 = 0$
$x = -\frac{2}{3}$. So A is $(-\frac{2}{3}; 0)$

12. Graph A has the equation $y = x$.
Graph B has the equation $y = 3x$.

GEOMETRY
Unit 3.1: Straight line geometry

Grade 7, 8 & 9

1a) parallel lines b) perpendicular lines
c) vertex 2. PQ is a ray
3. BC is a line segment. AD is not a line segment; it is a line.
4a) BD is a line. b) AC is a line segment.
c) AE is a ray.
5. There are 360 degrees in a revolution.
6. Adjacent angles
7a) acute angle b) straight angle c) reflex angle
d) obtuse angle e) obtuse angle f) acute angle
g) reflex angle h) right angle
8. obtuse angle 9. 180° and 360°
10. 180°; half a revolution 11. 90°
12. The point where the two arms of an angle meet.
13. … stay the same distance apart (equidistant).
14. 90° 15. Perpendicular lines 16. Parallel lines

Grade 8 & 9

1. False. Example: 30° and 60° are acute and make a right angle; 15° and 45° make an acute angle.

2a) $x + 3x + 2x = 180°$
$6x = 180°$ so $x = 30°$
b) $\hat{ECB} = 2x = 60°$

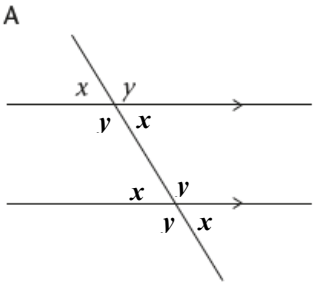
3a) $2p - 55° + 3p + 70° = 180°$
$5p + 15° = 180°$
$5p = 165°$ so $p = 33°$
b) $\hat{JKR} = 2(33°) - 55° = 11°$

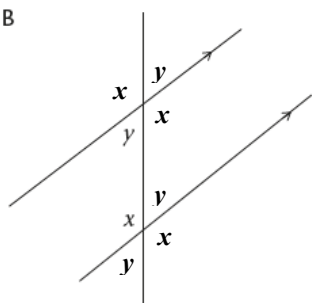
4. $j = 64°$ (vert opp ∠s)
. $j + k = 180°$ (∠s on a str line)
$\therefore k = 180° - 64° = 116°$
$l = 116°$ (vert opp ∠s)

5. . $a = 88°$ (vert opp ∠s)
$b = 62°$ (vert opp ∠s)
. $62° + 88° + c = 180°$ (adj ∠s on a str line)
$\therefore c = 180° - (88° + 62°) = 30°$
$\therefore d = 30°$(vert opp ∠s)

6. $102° - 2y = 78°$ (vert opp ∠s)
$24° = 2y$
$\therefore y = 12°$

7.





8. x = 105°
   Use adj ∠s on str line and corres ∠s on parallel lines.
   y = 165° (corres ∠s on parallel lines)
9. $b = 140°$ $c = 40°$ $d = 140°$
10. $A\hat{J}F = 50°$ and $C\hat{K}E = 130°$
11. $\hat{D} = 33°$
    $\therefore z = 33°$ (alternate ∠s on parallel lines CD // AB)
    $\therefore x = 147°$ (adjacent ∠s on a straight line)
    $\hat{B} = 21°$
    $\therefore y = 21°$ (alternate ∠s on parallel lines CD // AB)
12. $a = 26°$ (cointerior ∠s on parallel lines TS // PR)
    $c = 26°$ (alternate ∠s on parallel lines TS // PR)
    $b = 48°$ (corresponding ∠s on parallel lines TS // PR)
    $d = 180° - (26° + 48°) = 106°$ (adj ∠s on str line)
13. $B\hat{M}F = 100°$ and $N\hat{M}K = 100°$(adj ∠s on str line)
    $L\hat{M}K = 80°$ (vert opp ∠s)
    $M\hat{L}D = 80°$ (corres ∠s on parallel lines AB // CD)
    $H\hat{L}F = 80°$ (vert opp ∠s)
    $D\hat{L}J = 60°$ (adj ∠s on str line)
    $K\hat{L}H = 60°$ (vert opp ∠s)
    $M\hat{L}K = 40°$ (vert opp ∠s)
    $L\hat{F}H = 40°$ (alt ∠s on parallel lines IJ // EF)
    $L\hat{H}F = 60°$ (∠s of ΔHLF)
    $L\hat{H}G = 120°$ (adj ∠s on str line)
    $K\hat{G}E,\ A\hat{G}H,\ I\hat{K}M,\ G\hat{K}L = 120°$
    $K\hat{G}H,\ E\hat{G}A,\ I\hat{K}G,\ M\hat{K}L = 60°$

Unit 3.2: Triangles

Grade 7, 8 & 9

1 Note: Measurements might vary slightly
a) Triangle A: sides 2,4 cm; 2,7 cm and 3,6 cm
   90°; 47°; 43°
   Triangle B: sides 2,4 cm; 3 cm and 3 cm
   67°; 67°; 46°
   Triangle C: sides 3,4 cm; 2,3 cm and 5 cm
   125°; 22°; 33°
   Triangle D: 4 cm; 3,2 cm; 2,1 cm
   55°; 91°; 34°
   Triangle E: 2,7 cm; 2,8 cm; 2,8 cm
   61°; 58°; 61°
   Triangle F: 6,8 cm; 3,3 cm; 3,4 cm
   137°; 21°; 22°
b) A right-angled; B acute-angled; C obtuse-angled; D obtuse-angled; E acute-angled; F obtuse-angled
c) A is scalene; B is isosceles; C is scalene; D is scalene; E is isosceles; F is scalene.

2a) acute-angled and equilateral
b) acute-angled and scalene
c) right-angled and scalene
d) obtuse-angled and isosceles
e) acute-angled and isosceles
f) right-angled and isosceles

3a) obtuse-angled and scalene
b) acute-angled and isosceles
c) right-angled and scalene
d) acute-angled and scalene
e) obtuse-angled and isosceles
f) right-angled and isosceles

4a) See 3b). b) see 3c) c) see 3f)
d) not possible e) see 3d) f) see 3a)
f) not possible h) see 2a)

Grade 8 & 9

5. $D\hat{E}B = 70°$ (∠s of ΔDEB)
   $\therefore A\hat{C}B = 70°$ (corres ∠s on parallel lines DE // AC)
6. $p = 70°$ (∠s of ΔABC)
   $\therefore D\hat{A}C = 70°$ (alt ∠s on parallel lines DA // BC)
   $\therefore q = 80°$ (∠s of ΔADC)
7. $\hat{D}_1 = 48°$ (adjacent ∠s on a straight line)
   $\hat{D}_2 = 48°$ (vert opp ∠s)
   $\hat{D}_3 + \hat{D}_4 = 132°$ (vert opp ∠s)
   $\hat{A}_6 = 48°$ (alternate ∠s on parallel lines AB // KT)
   $\therefore \hat{B}_5 = 48°$ (isos ΔABD)
   $\therefore \hat{D}_3 = 180° - 96° = 84°$ (∠s of Δ ABD)
   $\therefore \hat{D}_4 = 132° - 84° = 48°$
8. $F\hat{H}G = 53°$ (vert opp ∠s)
   $\hat{F} = 180 - (90° + 53°) = 37°$
   $H\hat{I}D = 53°$ (alternate ∠s on parallel lines AB // CD)
   $\therefore E\hat{I}C = 53°$ (vert opp ∠s)
   $\therefore \hat{C} = 180° - (85° + 53°) = 42°$
   $\hat{D} = 110°$ ° (alternate ∠s on parallel lines AB // CD)
9. a) isosceles triangles
   b) obtuse-angled triangles
   c) isosceles triangles
   d) equilateral triangles
   e) all triangles
   f) all triangles
   g) all triangles
10. $a = 180° - (52° + 79°) = 49°$ (∠s of ΔDEF)
    $b = 180° - (40° + 35°) = 105°$ (∠s of ΔIJC)
    $c = 75°$ (adj ∠s on straight line)
    (ext ∠ equals sum of opp interior ∠s)
11. 4y + 5y = 180°
    9y = 180° so y = 20°
    $A\hat{B}C + A\hat{C}B$ = 3y + 4y = 7y = 140°
    $\therefore B\hat{A}C = 40°$

Unit 3.3: Quadrilaterals

Grade 7, 8 & 9

1a) parallelogram b) trapezium c) rectangle
d) kite e) quadrilateral f) rhombus g) rectangle

2a) AB = 45 mm; BC = 45 mm; AD = 45 mm
$\hat{A}$ = 90°; $\hat{B}$ = 90°; $\hat{C}$ = 90°; $\hat{D}$ = 90°
b) KN = 4 cm; NM = 4 cm;
$\hat{L}_1$ = 45°; $\hat{L}_2$ = 45°; $\hat{N}_1$ = 45°; $\hat{N}_2$ = 45°
c) EH = 8 cm; GH = 12 cm

Grade 8 & 9

3a) rhombus b) parallelogram c) kite
d) quadrilateral e) regular trapezium

4a) PS = 40 mm; RS = 90 mm;
$\hat{P}$ = 90°; $\hat{Q}$ = 90°; $\hat{R}$ = 90°; $\hat{S}$ = 90°
b) $\hat{L}$ = 100°; $\hat{M}$ = 80°; $\hat{N}$ = 100°

5.	parallel-ogram	rectangle	square	rhombus	trapeziu m	kite
diagonals bisect each other	✔	✔	✔	✔		
diagonals cut at right angles			✔	✔		

6a) WX = 7 cm; WZ = 7 cm;
$\hat{X}_1$ = 45°; $\hat{X}_2$ = 45°; $\hat{Y}_1$ = 45°; $\hat{Z}_1$ = 45°

b) BC = 15 mm; $\hat{C}_2 = 60°$; $\hat{A}_1 = 60°$; $\hat{A}_2 = 30°$
c) $x = 90°$; $y = 30°$; $z = 30°$; $a = 30°$; $b = 90°$; $c = 60°$.

7a) $a = 90°$ (given); $b = 45°$ (isos Δ); reflex ∠ = 267° so inside ∠ = 360° – 267° = 93° ∴ c = 360° – (63° + 59° + 93°) = 145° (∠s of quad add up to 360°); $d = 45°$ (opp ∠s of parm equal); $e = 135°$ (coint ∠s on parallel lines).

Unit 3.4: Congruency and similarity

Grade 7, 8 & 9

1a) Shape H is congruent to B.
b) Shapes A, D and H are similar to B.

2a) parallelogram (2 pairs of opp sides equal and parallel)
b) ∠M = 65° (cointerior angles on parallel lines)
∠P = 115° (cointerior angles on parallel lines)
So ∠M = ∠K = ∠S = ∠Q (opposite angles of parallelograms are equal)
And ∠P = ∠R = ∠J = ∠L (opposite angles of parallelograms are equal)
KL = 6 cm; JK = 3 cm; PS = 2 cm and PQ = 1 cm (opposite sides of parallelograms are equal)
So $\frac{JM}{PS} = \frac{ML}{SR} = \frac{KL}{QR} = \frac{JK}{PQ}$
So JKLM ||| PQRS (sides in proportion and angles equal)

3a) True b) False
c) False d) True
e) False f) False
g) False h) False
h) True j) True

Grade 9

4a) Triangles are not congruent or similar. Equal angles and sides are not in corresponding positions.
b) ΔFGH ≡ ΔTKL (RHS)
c) Triangles are not congruent or similar.
d) ΔFUN ≡ ΔDEA (SAA)
e) ΔABC ≡ ΔDCB (SSS)
f) ΔABC ||| ΔONM (SSS)

5a) False. b) False
c) True d) False

6. In ΔABC and ΔADC
AB = AD (adj sides of kite)
BC = DC (adj sides of kite)
AC is common
∴ ΔABC ≡ ΔADC (SSS)

7. In ΔABD and ΔACD
AB = AC (given)
BD = CD (given)
AD is common
∴ ΔABD ≡ ΔACD (SSS)

8. In ΔABD and ΔCDB
$B\hat{A}D = D\hat{C}B = 90°$ (given)
AD = CB (given)
BD is common
∴ ΔABD ≡ ΔCDB (RHS)

9. a) ABCD is a parallelogram
∴ $\hat{B}_1 + \hat{B}_2 + \hat{C}_1 + C_2 = 180°$ (coint ∠s AB || CD)
$\hat{B}_1 = \hat{B}_2$ (TB bisects $\hat{B}$)
$\hat{C}_1 = \hat{C}_2$ (TC bisects $\hat{C}$)
∴ $2\hat{B}_1 + 2\hat{C}_1 = 180°$
∴ $\hat{B}_1 + \hat{C}_1 = 90°$
$\hat{B}_1 + \hat{C}_1 + \hat{T}_2 = 180°$ (∠s of ΔBTC)
∴ $\hat{T}_2 = 90°$
b) ΔTCP c) BT = 4 cm × 2 = 8 cm

10. ST and UV vertical, so ST ⊥ TW and UV ⊥ VW.
ST || UV.
In ΔUVW and ΔSTW
$\hat{W}$ is common
$V\hat{U}W = T\hat{S}W$ (corres ∠s ST || UV)
$U\hat{V}W = S\hat{T}U = 90°$ (ST ⊥ TW and UV ⊥ VW)
∴ ΔUVW ||| ΔSTW
∴ UV : VW = ST : TW
1 : 1,7 = ST : 5,1
$\frac{1}{1,7} = \frac{ST}{5,1}$ so ST = $\frac{5,1 \times 1}{1,7} = 3$ metres

11a) Angle A is common to both triangles, $A\hat{B}F = \hat{C}$ and $A\hat{F}B = \hat{D}$ because they are corresponding angles on parallel lines. So ΔABF ||| ΔACD.

b) $\frac{AB}{AC} = \frac{AF}{AD} = \frac{BF}{CD}$ (similar triangles)
$\frac{5}{8} = \frac{4}{4+y} = \frac{x}{9}$
To find x: $\frac{5}{8} = \frac{x}{9}$ so $8x = 45$ $x = 5,6$ cm
To find y: $\frac{5}{8} = \frac{4}{4+y}$ so $5(4+y) = 32$
$20 + 5y = 32$
$5y = 12$ so $y = 2,4$ cm

12. Hints:
Outline the congruent triangles and mark all equal angles and sides. They are, so you can use the pairs of equal angles to show that ED || GF.
ΔCDE ≡ ΔFCG (given)
∴ $C\hat{E}D = C\hat{G}F$
∴ ED || GF (corres ∠s equal)

Unit 3.5: Congruency and similarity

Grade 7, 8 & 9

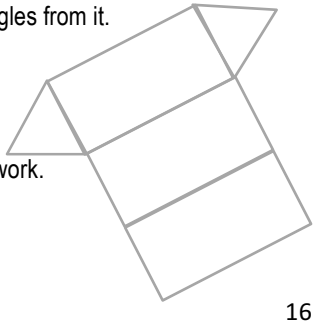
1. cube, right hexagon-based prism; right pentagonal prism; square-based pyramid; right triangular prism.

2a) 5 faces; 9 edges; 6 vertices
b) 10 faces; 24 edges; 16 vertices
c) 6 faces; 12 edges; 8 vertices

3a) triangular prism b) square-based pyramid
c) can't be folded to make a 3D object
d) triangular prism

4a) Hint: Copy the size of the front rectangle of the object and estimate the sizes of the other rectangles from it.

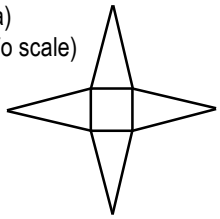
b) Hint: Copy the size of the front triangle of the object and build the rectangles from it.



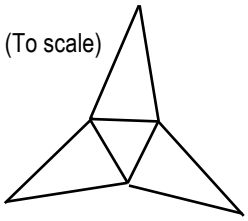
5. Only c), f) and h) will work.

Grade 8 & 9

6a) (To scale)



b) (To scale)



7. A, D, F, H and I are made of identical regular polygons, so they are Platonic solids.

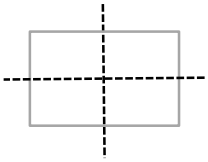
Grade 9

8a) cube b) rectangular prism
c) square based pyramid
d) tetrahedron
e) octahedron
f) sphere
g) dodecahedron

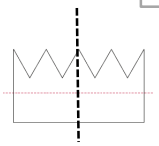
Unit 3.6: Transformation Geometry

0**Grade 7, 8 & 9**

1a) yes
b) no. There are 2 lines lines of symmetry:

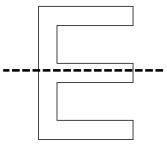


c) yes
d) no. There is one line of symmetry:

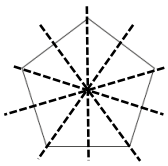


e) No, there are no lines of symmetry for this shape.
f) No. There are no lines of symmetry

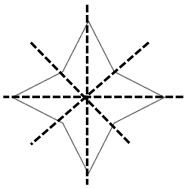
2a)



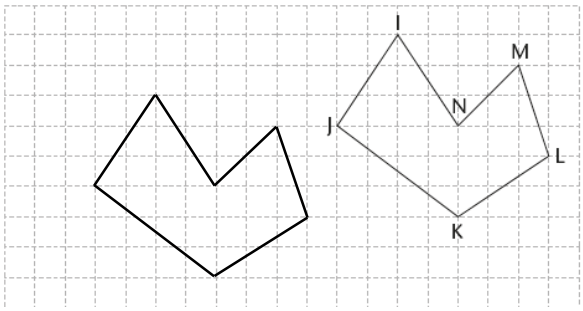
b)



c)

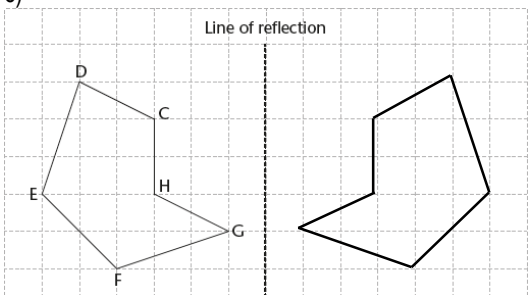


3a)

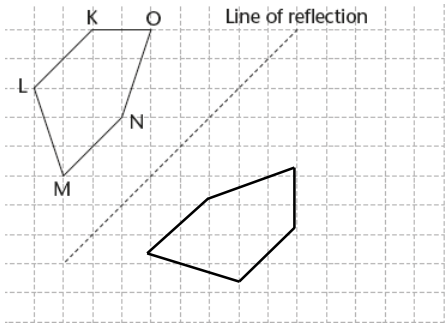


b) ABCD is translated up 3 units and 7 units to the right.

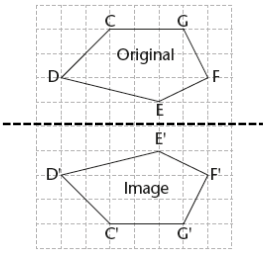
c)



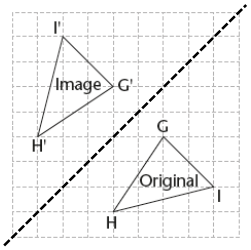
d)



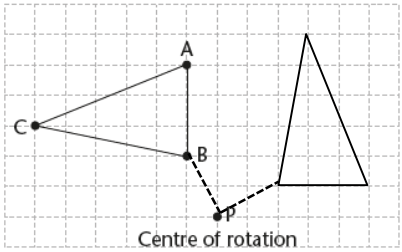
4a)



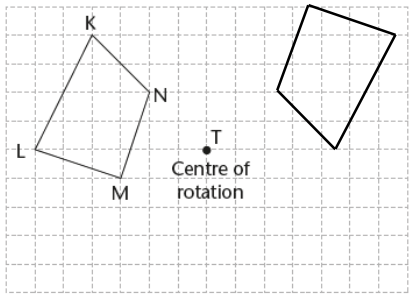
b)



5a)



b)



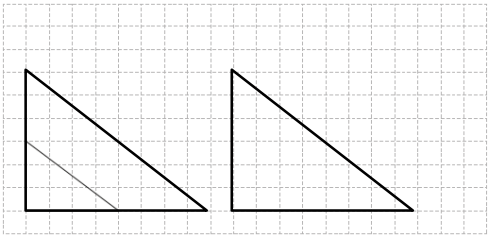
6a) FG is double (2×) the length of BC.
EF is double (2×) the length of AB.
EG is double (2×) the length of AC.

b) JK is half the length of BC.
IJ is half the length of AB.
IK is half the length of AC.

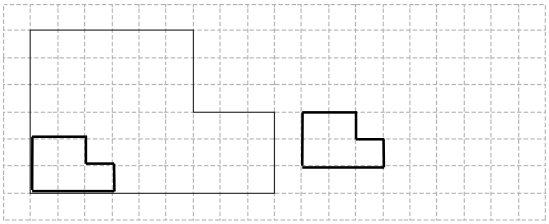
c) ΔEFG is an enlargement of ΔABC by a scale factor of 2 because all the sides of the lengths are doubled in the same proportions.

d) ΔIJK is a reduction of ΔABC by a scale factor of ½ because all the sides of the lengths are halved in the same proportions.

7a) The enlargement can be positioned in different ways on the grid. Here are two examples.



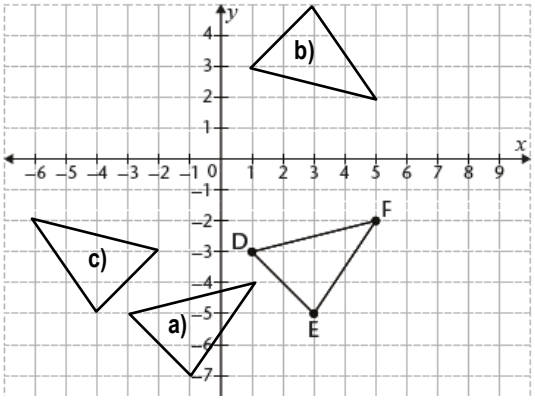
b) The reduction can be positioned in different ways on the grid. Here are two examples.



8. Image 1 is a rotation of 90° clockwise with the centre of rotation at the bottom right corner of Figure 1.
Image 2 is reflection of Figure 1 with the line of symmetry on the bottom length of Figure 1.
Image 3 is a translation of Figure 1. It has moved 7 units to the right and 2 units up on the grid.

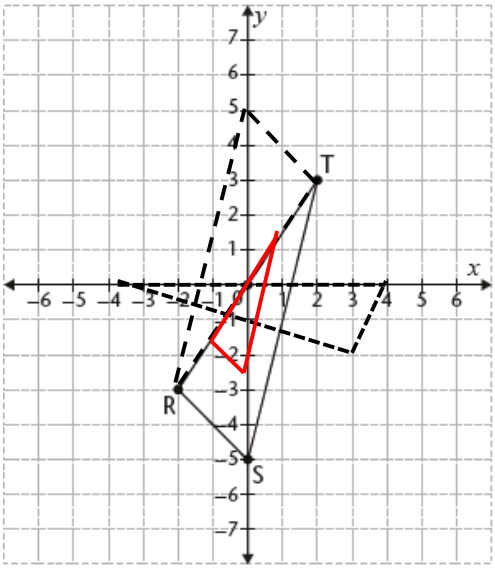
Grade 8 & 9

9.



a) ΔD'E'F' has vertices D' (–3; –5); E' (–1; –7); F' (1; –4)
b) ΔD''E''F'' has vertices D'' (1; 3); E'' (3; 5); F'' (5; 2)
c) ΔD'''E'''F''' has vertices D'''(–2; –3); E'''(–4; –5); F'''(–6; –2)

10a) R'(2; 3); S'(0; 5) T'(–2; –3)
b) R''(3; –2); S''(4; 0); T''(–4; 0)
c) R'''(–1; –1½); S'''(0; –2½); T'''1; 1½).



11. ΔABC has vertices A(–1; –5), B(–3; 2) and C (2; 1).
a) ΔABC has been translated 1 unit to the right and 1 unit down to create ΔA'B'C'.
b) ΔABC has been rotated 180° about the origin to create ΔA'B'C'.
c) ΔABC has been enlarged by a scale factor of 3 to create ΔA'B'C'.
d) ΔABC has been reflected in the y-axis to create ΔA'B'C'.
e) ΔABC has been translated 2 units to the right to create ΔA'B'C'.
f) ΔABC has been rotated 90° anti-clockwise about the origin to create ΔA'B'C'.
g) ΔABC has been reflected in the line $y = x$ to create ΔA'B'C'.

12a) The rectangle has been enlarged by a scale factor of 2½. 4 cm × 2½ = 10 cm and 6 cm × 2½ = 15 cm
b) Area of original rectangle = 4 × 6 = 24 cm²
Area of enlarged rectangle = 10 × 15 = 150 cm²
150 ÷ 24 = 6,25 so the area has been enlarged by 6,25 cm².

13.	Translation 4 units up and 3 units to the left	Rotated about the origin through 90° clockwise	Reflected in the line $y = x$
A (–2; 1)	(–5; 5)	(1; 2)	(1; –2)
B (3; 4)	(0; 8)	(4; –3)	(4; 3)
C (5; –2)	(2; 2)	(–2; –5)	(–2; 5)

14. To work this out, start with $(x; y)$
$(x; y) \rightarrow$ reflected in line $y = x \rightarrow (y; x)$
$(y; x) \rightarrow$ 1 down, 3 right $\rightarrow (y - 1; x + 3)$
$(y - 1; x + 3) \rightarrow$ enlarged by factor of 5 $\rightarrow$
$(5(y - 1); 5(x + 3)) = (5y - 5; 5x + 15)$

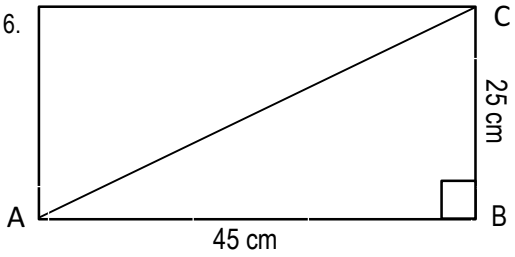
A (–1; –5) → A' (5(–5) – 5); 5(–1) + 15) = A' (–30; 10)
B (–3; 2) → B' (5; 0) and C (2; 1) → C' (0; 20)

MEASUREMENT
Unit 4.1: Pythagoras Theorem

Grade 8 and 9

1a) right-angled b) hypotenuse
c) hypotenuse d) QP
e) No, because a triangle has 3 angles which add up to 180° and 2 right angles added together is 90° + 90° which adds up to 180° leaving no space for a third angle.
f) 3; 4; 5 g) 5; 12; 13 h) 6; 8; 10
2 a) $a^2 + b^2 = c^2$ b) $c^2 - a^2 = b^2$
c) $a^2 = c^2 - b^2$ d) $c^2 = a^2 + b^2$
3. $\text{QR}^2 = \text{PQ}^2 + \text{PR}^2$
$\text{PR}^2 = \text{QR}^2 - \text{PQ}^2$
$\text{PR}^2 = 13^2 - 5^2$
$\text{PR}^2 = 144$
$\text{PR} = \sqrt{144}$
$\text{PR} = 12 \text{ mm}$
4. In ΔMNR, $\text{RN}^2 = \text{MN}^2 - \text{MR}^2$
$\text{RN}^2 = 102^2 - 62^2$
$\text{RN}^2 = 6\,560$
$\text{RN} = \sqrt{6\,560}$ (use in this form without rounding off)
In ΔTRN,
$\text{TR}^2 = \text{RN}^2 + \text{NT}^2$
$\text{TR}^2 = 48^2 + (\sqrt{6\,560})^2$
$\text{TR}^2 = 8\,864$
$\text{TR} = \sqrt{8\,864}$
$\text{TR} = 94{,}15 \text{ km}$
5. In ΔABD, $\text{BD}^2 = \text{AB}^2 - \text{AD}^2$
$\text{BD}^2 = 25^2 - 8^2$
$\text{BD}^2 = 561$
$\text{BD} = \sqrt{561}$
In ΔACD, $\text{CD}^2 = \text{AC}^2 - \text{AD}^2$
$\text{CD}^2 = 8{,}54^2 - 8^2 = 8{,}9316$
$\text{CD} = 2{,}988 \ldots$
BC = BD – CD
BC = 23,685…≈ 24 cm

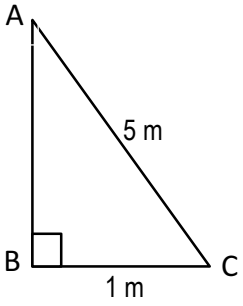
6.



$\text{AC}^2 = \text{AB}^2 + \text{BC}^2$
$\text{AC}^2 = 45^2 + 25^2$
$\text{AC}^2 = 2\,650$
$\text{AC} = \sqrt{2\,650}$
$\text{AC} = 51{,}48 \text{ cm}$

7. $3^2 + 3^2 = 18$; $5^2 = 25$
The diagonal of the square is $\sqrt{18} \neq 5$
By Pythagoras theorem, it is not possible.
8. a) $\text{CH}^2 = \text{HG}^2 + \text{CG}^2$
$\text{CH}^2 = 16^2 + 8^2$
$\text{CH}^2 = 320$
$\text{CH} = \sqrt{320}$
$\text{AC}^2 = \text{AB}^2 + \text{BC}^2$
$\text{AC}^2 = 16^2 + 10^2$
$\text{AC}^2 = 356$
$\text{AC} = \sqrt{356}$
$\text{AH}^2 = \text{AE}^2 + \text{EH}^2$
$\text{AH}^2 = 8^2 + 10^2$
$\text{AH}^2 = 164$
$\text{AH} = \sqrt{164}$
b) $\text{AH}^2 + \text{CH}^2 = 164 + 320 = 484$
$\text{AC}^2 = 356$
So $\text{AC}^2 \neq \text{AH}^2 + \text{CH}^2$
So ΔACH is not right-angled.

9a)



$\text{AB}^2 = \text{AC}^2 - \text{BC}^2 = 5^2 - 1^2$
$\text{AB}^2 = 24$
$\text{AB} = \sqrt{24} = 4{,}8989.. \approx 4{,}90 \text{ m}$
The ladder reaches 4,90 m up the wall.

b) $\text{BC}^2 = \text{AC}^2 - \text{AB}^2$
$\text{BC}^2 = 5^2 - 4{,}5^2 = 4{,}75$
$\text{BC} = \sqrt{4{,}75}$ = 2,18 m away from wall

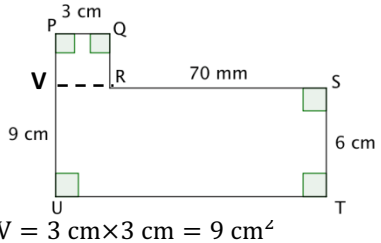
10. a) QD = DC – CQ
QD = 4 – 1,5
QD = 2,5 cm
b) $\text{PQ}^2 = \text{CP}^2 + \text{CQ}^2$
$\text{PQ}^2 = 4{,}2^2 + 1{,}5^2$
$\text{PQ}^2 = 19{,}89$
$\text{PQ} = \sqrt{19{,}89} = 4{,}46 \text{ cm}$

Unit 4.2: Perimeter and area

Grade 7, 8 and 9

1a) 90 cm b) 7 000 m
c) 760 cm d) 132 000 cm
e) 943, 217 km
2a) $5 \times (10 \text{ mm})^2 = 500 \text{ mm}^2$
b) $8{,}25 \times (100 \text{ cm})^2 = 82\,500 \text{ cm}^2$
c) $245\,000\,000 \div (1\,000 \text{ km})^2 = 245 \text{ km}^2$
d) $5{,}32 \times (1\,000 \text{ km})^2 = 5\,320\,000 \text{ m}^2$
e) $347\,012 \div (10 \text{ mm})^2 = 3\,470{,}12 \text{ cm}^2$
3. Area = $4{,}7 \text{ m} \times 2{,}3 \text{ m} = 10{,}81 \text{m}^2$

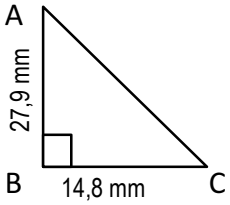
4. Perimeter = 15,3 cm×2 + 19,2 cm×2
$= 30{,}6\text{ cm} + 38{,}4\text{ cm} = 69\text{ cm}$
5. Area = length ×breadth
$13{,}23\text{ cm}^2 = 6{,}3\text{ cm}\times\text{breadth}$
$\text{breadth} = 13{,}23\text{ cm}^2 \div 6{,}3\text{ cm} = 2{,}1\text{ cm}$
6. Area $= \frac{1}{2}\times b\times h$
$17{,}5\ \text{m}^2 = \frac{1}{2}\times 5\text{ m}\times h$
$h = 17{,}5\text{ m}^2\times 2 \div 5\text{ m} = 7\text{ m}$
7a) Perimeter $= 8\text{ cm} + 20\text{ cm} + 13\text{ cm} = 41\text{ cm}$
b) Area = $\frac{1}{2}\times$ base $\times \perp$ height
Area = $\frac{1}{2}\times 20\times 5 = 50\text{ cm}^2$
8a) $\text{QR} = 9\text{ cm} - 6\text{ cm} = 3\text{ cm};\ 70\text{ mm} = 7\text{ cm}$
$\text{TU} = 3\text{ cm} + 7\text{ cm} = 10\text{ cm}$
$\text{P} = 9 + 3 + 3 + 7 + 6 + 10 = 38\text{ cm}$
b) Join VR:



Area of $\text{PQRV} = 3\text{ cm}\times 3\text{ cm} = 9\text{ cm}^2$
Area of $\text{VSTU} = 10\text{ cm}\times 6\text{ cm} = 60\text{ cm}^2$
$\therefore$ Area of $\text{PQRSTU} = 9\text{ cm}^2 + 60\text{ cm}^2 = 69\text{ cm}^2$

Grade 8 and 9

9a) Area of $\Delta\text{ABC} = \frac{1}{2}\times 27{,}9\text{ mm}\times 14{,}8\text{ mm}$
$= 206{,}46\text{ mm}^2 = 2{,}06\text{ cm}^2$
b) Find AC first.
$\text{AC}^2 = \text{AB}^2 + \text{BC}^2$
$\text{AC}^2 = (27{,}9)^2 + (14{,}8)^2$
$\text{AC}^2 = 997{,}45\text{ mm}^2$
$\therefore\ \text{AC} = 31{,}6\text{ mm}$



$\therefore$ Perimeter $= 27{,}9 + 14{,}8 + 31{,}6 = 74{,}3\text{ mm}$
$74{,}3\text{ mm} = 7{,}43\text{ cm}$
10 To find BD:
$\text{BD}^2 = \text{AB}^2 - \text{AD}^2$
$\text{BD}^2 = 8^2 - 5^2$
$\text{BD}^2 = 39$
$\text{BD} = \sqrt{39} \approx 6{,}24\text{ cm}$
Area of $\Delta\text{ABD} = \frac{1}{2}\times\text{BD}\times\text{AD}$
Area of $\Delta\text{ABD} = \frac{1}{2}\times 6{,}24\times 5 = 15{,}6\text{ cm}^2$
Perimeter of of $\Delta\text{ABD} = 8 + 5 + 6{,}24 = 19{,}24\text{ cm}$
11a) Area = $\pi r^2 = \pi\times 7^2 = 153{,}94\text{ cm}^2$
b) Circumference = $2\pi\, r = 2\times\pi\times 7 = 43{,}98\text{ cm}$
12a) Area $= \pi r^2 = \pi\times(36 \div 2)^2$
$= \pi\times 18^2 = 1\,017{,}88\text{ m}^2$
b) Circumference $= 2\pi\, r = 2\times\pi\times 18 = 113{,}1\text{ m}$
13a) Area = $\pi r^2 = 50{,}27 = \pi\times r^2$
$r^2 = 50{,}27 \div \pi = 16$
$r = \sqrt{50{,}27 \div \pi}$
$\therefore\ r = 4\text{ cm}$
b) Diameter = $r \times 2 = 4\text{ cm}\times 2 = 8\text{ cm}$
c) Circumference = $2\pi\, r = 2\times\pi\times 4 = 25{,}13\text{ cm}$
14a) $\frac{3}{4}$ of the circle is left
b) Area $= \pi r^2\times\frac{3}{4}$
$= \pi\times(16 \div 2)^2\times\frac{3}{4}$
$= 150{,}8\text{ m}^2$
c) Perimeter = $\frac{3}{4}\times 2\,\pi\, r + 2r$
$= \left(\frac{3}{4}\times 2\times\pi\times 8\right) + (2\times 8) = 53{,}7\text{ m}$
15. Area $= big\ circle\ area - smaller\ circle\ area$
Area $= \pi\times(3)^2 - \pi\times(2{,}1)^2$
Area $= 9\pi - 4{,}41\pi = 14{,}42\text{ mm}^2$

Grade 9

16a) Area $= 10\text{ cm}\times 4\text{ cm} = 40\text{ cm}^2$
To find lengths of sides: $(side)^2 = 3^2 + 4^2 = 25$
$\therefore$ side $= 5$ cm
Perimeter $= 2(10) + 2(5) = 30\text{ cm}$
b) $\text{BC} = \text{CD} = 5\text{ cm}$
$\therefore\ \text{BD} = 5\text{ cm} + 5\text{ cm} = 10\text{ cm}$
$\text{CE}^2 = 13^2 - 5^2 = 144$
$\text{CE} = \sqrt{144} = 12\text{ cm}$
$\text{AE} = 5\text{ cm} + 12\text{ cm} = 17\text{ cm}$
$\text{Area} = \left(\frac{1}{2}\times 10\text{ cm}\right)\times\left(\frac{1}{2}\times 17\text{ cm}\right) = 42{,}5\text{ cm}^2$
To find perimeter, first find AB.
$\text{AB}^2 = \text{AC}^2 + \text{BC}^2 = 5^2 + 5^2 = 50$
$\therefore\ \text{AB} = \sqrt{50}$
$\therefore$ Perimeter $= 2(13) + 2\left(\sqrt{50}\right) = 40{,}14\text{ cm}$
17a) Perimeter of new rectangle = 30 m × 2 = 60 m
b) Area of new rectangle = 36 m² × 4 = 144 m²
18a) The circumference of the circle will be doubled.
b) The area of the circle will be 4 times its original size.
19a) CE = 3 cm (Pythagoras on ∆CDE)
Area trapezium = area rectangle + area Δ
$= 12\text{ cm}\times 4\text{ cm} + (\frac{1}{2}\times 3\times 4) = 54\text{ cm}^2$
Perimeter $= 12 + 4 + 3 + 12 + 5 = 36\text{ cm}$
b) Area QRSY $= \frac{1}{2}\times 6\text{ m}\times(12\text{ m} + 10\text{ m}) = 66\text{ m}^2$
Area STXY $= 7\text{ m}\times 6\text{ m} = 42\text{ m}^2$
Total area $= 66\text{ m}^2 + 42\text{ m}^2$
$= 108\text{ m}^2$
For perimeter, PQ = 12 – 10 = 2 m
$\text{QR}^2 = \text{PQ}^2 + \text{PR}^2 = 2^2 + 6^2 = 40$
$\text{QR} = \sqrt{40} = 6{,}3\text{ m}$
Perimeter $= 12 + 7 + 7 + 7 + 10 + 6{,}3$
$= 49{,}3\text{ m}$
c) Area = ½ LN × ½ PM
To find LN:
$\text{ON}^2 = 13^2 - 5^2 = 144$
$\text{ON} = \sqrt{144} = 12\text{ cm}$
$\text{LO}^2 = 20^2 - 5^2 = 375$
$\text{LO} = \sqrt{375} = 19{,}36\text{ cm}$
$\therefore\ \text{LN} = 12 + 19{,}36 = 31{,}36\text{ cm}$

PO = OM (diag PM bisected by LN)

$\therefore$ PM $= 5 + 5 = 10$ cm

Area $= \frac{1}{2}$(LN $\times$PM)

$= \frac{1}{2}(31{,}36\text{ cm}\times 10\text{ cm}) = 156{,}8\text{ m}^2$

Perimeter $= 20\text{ cm}\times 2 + 13\text{ cm}\times 2 = 66$ cm

d) To find height of parallelogram FGJK, find OF.

$OF^2 = 10^2 - 6^2$ (Pythagoras)

$OF^2 = 64$

$OF = \sqrt{64} = 8$

Area of FGJK $= 18\times 8 = 144\text{ m}^2$

To find height of trapezium GHIJ,

$OH^2 = 8^2 - 6^2 = 28$

$OH = \sqrt{28} = 5{,}29$ m

Area of trapezium $= \frac{1}{2}\times(9 + 18)\times 5{,}29$

$= 71{,}42\text{ m}^2$

Total area $= 144\text{ m}^2 + 71{,}42\text{ m}^2$

$= 215{,}42\text{ m}^2$

Perimeter of FGHIJK:

Draw perpendicular from I to GJ meeting GJ at L

JL = 18 cm – 6 cm – 9 cm = 3 cm

$IJ^2 = 5{,}29^2 + 3^2$

IJ = 6,08 m

Perimeter = 10 + 18 + 10 + 6,08 + 9 + 8 = 61,08 m

Unit 4.3: 3D shapes and volume

Grade 7,8 and 9

1a) Volume $= 400\text{ mm}\times 300\text{ mm}\times 200\text{ mm}$

$= 24\,000\,000\text{ mm}^3$

b) $24\,000\,000\text{ mm}^3 \div 1\,000 = 24\,000\text{ cm}^3$

c) Total surface area

$= 2(400\times 200) + 2(400\times 300) + 2(200\times 300)$

$= 520\,000\text{ mm}^2$

2a) Volume $= 50\text{ mm}\times 50\text{ mm}\times 50\text{ mm}$

$= 125\,000\text{ mm}^3 = 125\text{ cm}^3$

b) Total surface area $= 6(50\text{ mm}\times 50\text{ mm})$

$= 15\,000\text{ mm}^2 = 150\text{ cm}^3$

3. Total surface area

$= 4(1\times 2) + 2(1\times 1) + 3(5\times 1) + (3\times 1)$

$= 28\text{ m}^2$

4a) Volume $= 3\text{ m}\times 2\text{ m}\times 1\text{ m} = 6\text{ m}^3$

b) $6\text{ m}^3 = 6\,000\,000\text{ cm}^3 = 6\,000\ l = 6\ kl$

5a) $\sqrt[3]{25{,}625\text{ cm}^3} = 2{,}95$ cm

b) Volume $= (5\text{cm})^3 = 125\text{ cm}^3$

6a) Vol $= (1\times 10\times 5) + (1\times 3\times 10) = 80\text{cm}^3$

b) Total surface area $= (5\text{cm}\times 10\text{cm}) +$

$3(1\text{cm}\times 10\text{cm}) + 2(1\text{cm}\times 5\text{cm}) + 2(3\text{cm}\times 1\text{cm}) +$

$2(2\text{cm}\times 10\text{cm}) + 2(3\text{cm}\times 10\text{cm})$

$= 196\text{ cm}^2$

Grade 8 and 9

7a) $h^2 = 5^2 - 3^2$

$h^2 = 16$

$h = \sqrt{16}$ $h = 4$ cm

b) i) Volume $= \frac{1}{2}bh$H

$= \frac{1}{2}\times 6\text{ cm}\times 4\text{ cm}\times 20\text{ cm}$

$= 240\text{ cm}^3$

ii) Total surface area $= bh + (s_1 + s_2 + b)\times H$

$= (6\text{cm}\times 4\text{cm}) + (5\text{cm} + 5\text{cm} + 6\text{cm})\times 20\text{cm}$

$= 344\text{ cm}^2$

8a) Total surface area $= 5(4\text{ m}\times 4\text{ m}) = 80\text{ m}^2$

b) $80 \div 2 = 40\ l$

9a) $h^2 = 6^2 - 3^2$

$h^2 = 27$

$h = \sqrt{27}$

$h = 5{,}2$ cm

Volume $= \frac{1}{2}bhH$

$= \frac{1}{2}\times 6\text{ cm}\times 5{,}2\text{ cm}\times 12\text{ cm} = 187{,}2\text{ cm}^3$

b) Total surface area $= bh + (s_1 + s_2 + b)\times$H

$= (6\text{cm}\times 5{,}2\text{cm}) + (6\text{cm} + 6\text{cm} + 6\text{cm})\times 12\text{cm}$

$= 247{,}2\text{ cm}^2$

10a) Volume $= 5{,}8\text{ m}\times 2{,}3\text{ m}\times 2{,}3\text{ m}$

$= 30{,}68\text{ m}^3$

b) $90 \div 30{,}68 = 2{,}93 \approx 3$ containers

$3\times$R40 000 $=$ R120 000

11. Surface area of bottom part

$= 2(1\text{ m}\times 2{,}5\text{ m}) + 2(2{,}5\text{ m}\times 2\text{ m}) = 15\text{ m}^2$

To find side length of roof:

$s^2 = 1{,}5^2 + 0{,}5^2 = 2{,}5$

$s = \sqrt{2{,}5} = 1{,}58$ m

Surface area of top part $= 2\left(\frac{1}{2}\times 1\times 1{,}5\right) +$

$2(1{,}58\text{ m}\times 2\text{ m}) = 7{,}82\text{ m}^2$

Total surface area $= 15\text{ m}^2 + 7{,}82\text{ m}^2 = 22{,}82\text{ m}^2$

Grade 9

12a) Volume $= \pi r^2 h$

$= \pi\times(1\text{ m})^2\times 5\text{ m}$

$= 15{,}71\text{ m}^3$

b) Area $= 2\pi r^2 + 2\pi rh$

$= 2\pi(1)^2 + 2\pi(1)(5)$

$= 37{,}7\text{ m}^2$

13a) Volume $= 5\text{ m}\times 2\text{ m}\times 3\text{ m} = 30\text{ m}^3$

b) Volume $= 10\text{ m}\times 4\text{ m}\times 6\text{ m} = 240\text{ m}^3$

14a) Volume $= \pi r^2 h\times\frac{3}{4}$

$= \pi\times 4^2\times 10\times\frac{3}{4}$

$= 376{,}99\text{ cm}^3$

b) Volume $= 2\text{cm}\times 2\text{cm}\times 2\text{cm}$

$= 8\text{cm}^3$

2 ice cubes= 2(8) =16 cm^3

Total volume $= \pi r^2 h$

$= \pi\times 4^2\times 10$

$= 502{,}65\text{ cm}^3$

$502{,}65 - 376{,}99 = 125{,}66\text{ cm}^3$

Therefore the water in the glass will not overflow as $125{,}66\text{ cm}^3 > 16\text{cm}^3$.

DATA HANDLING & PROBABILITY
Unit 5.1: Collect, organise and summarise data

Grade 7, 8 and 9

1a) 10; 14; 15; 23; 27; 38; 44; 44; 47; 47; 47; 47; 60; 72; 83; 84; 84; 87; 91; 93

Mean = $\frac{\text{total}}{20} = \frac{1\,057}{20}$ = 52,85

Median: 47

Mode: 47

Range: 93 – 10 = 83

b) 13; 20; 24; 25; 26; 26; 29; 29; 31; 36; 60; 69; 79; 79; 84; 84; 84; 86; 89; 95

Mean = $\frac{\text{total}}{20} = \frac{1\,068}{20}$ = 53,4

Median = $\frac{36+60}{2}$ = 48

Mode = 84

Range = 95 – 13 = 82

c) 10; 27; 28; 36; 42; 45; 45; 47; 59; 69; 73; 73; 79; 82; 97

Mean = $\frac{\text{total}}{20} = \frac{812}{15}$ = 54,13

Median = 47

Mode = 45 and 73

Range = 97 – 10 = 87

d) 8; 8; 16; 18; 19; 23; 23; 52; 57; 57; 59; 59; 71; 71; 76

Mean = $\frac{\text{total}}{15} = \frac{617}{15}$ = 41,13

Median = 52

Mode = 8, 23, 57 and 71

Range = 76 – 8 = 68

2a)

Stem	Leaf
0	
1	8, 9
2	0, 2, 2, 2, 4, 5, 6, 6, 7, 9
3	1, 1, 2

b) i) Range = 32 – 18 = 14

ii) Median = 25

iii) Mean = $\frac{\text{total}}{15} = \frac{374}{15}$ =24,93

iv) Mode = 22

c) Looking at the mean and median, he sells an average of 25 brownies a day with a range of 14 between his highest and lowest sales which means there was quite a big difference between the most brownies sold and the least brownies sold in a day.

3. a)

Interval	Frequency
less than 1,0 km	25
1,0 – 5,9 km	22
6,0 – 9,9 km	7
10 km or further	6

b) 25 out of 60 learners = $\frac{25}{60} \times \frac{100}{1}\% = 41{,}7\%$

4. a)

Interval	Weights
$55\text{ kg} \leq x < 60\text{ kg}$	55,2; 56,1; 58,4; 59,3.
$60\text{ kg} \leq x < 65\text{ kg}$	60,6; 61,2; 61,7; 63,4; 63,2; 64,2.
$65\text{ kg} \leq x < 70\text{ kg}$	65,9; 66,5; 66,7; 67,3; 67,8; 68,0.
$70\text{ kg} \leq x < 75\text{ kg}$	70,5; 72,9; 73,4; 74,1; 74,8.
$75\text{ kg} \leq x < 80\text{ kg}$	75, 9; 76,7; 78,7.

b)

Body weights of athletes	Tally	Frequency
$55\text{ kg} \leq x < 60\text{ kg}$	IIII	4
$60\text{ kg} \leq x < 65\text{ kg}$	IIII I	6
$65\text{ kg} \leq x < 70\text{ kg}$	IIII I	6
$70\text{ kg} \leq x < 75\text{ kg}$	IIII	5
$75\text{ kg} \leq x < 80\text{ kg}$	III	3

c) 60 kg ≤ x < 65 kg and 65 kg ≤ x < 70 kg

5a) 340 g

b) 411 g

c) 378,5 g

6. 3; 4; 5; 6; 7; 7; 7; 7; 7; 7; 8; 8; 9; 9; 10; 11; 13; 15; 15; 19; 23; 25.

Median = 8

Therefore Bongile can claim that his mark is in the top half of the class because his mark (9) is above the median (8) of the class's mark.

7.

a) Yes, there are more shops in City A where the price of white bread is cheaper than the price of white bread in the shops in City B.

b) City A: Mean = $\frac{\text{total}}{10} = \frac{8\,909}{10}$ = 890,9 cents

City B: Mean = $\frac{\text{total}}{10} = \frac{9\,099}{10}$ = 909,9 cents

c) City A:

831; 861; 880; 885; 888; 889; 899; 904; 927; 937

Median = $\frac{888+899}{2}$ = 888,5 cents

City B:

872; 872; 890; 900; 908; 910; 924; 933; 942; 948

Median = $\frac{908+910}{2}$ = 909 cents

8. The median will give a better representation of the average of the data as the outlier, 59, distorts the mean.

Unit 5.2: Represent Data with Graphs

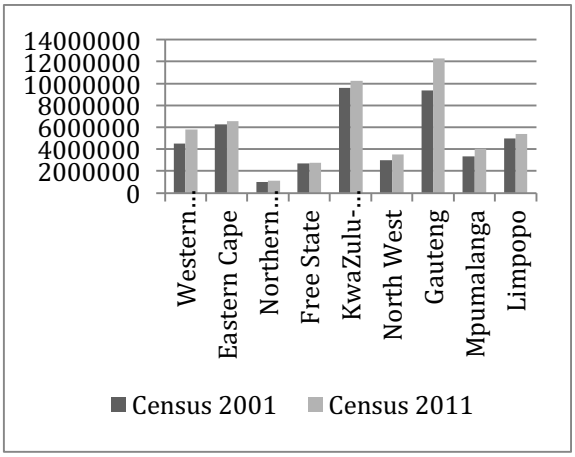
Grade 7, 8 and 9

1a) Northern Cape

b) $\frac{10.6}{100} \times 360° = 38{,}16°$

c) $\frac{10{,}3}{100} \times 1\,213\,090 = 124\,948{,}27\text{ km}^2$

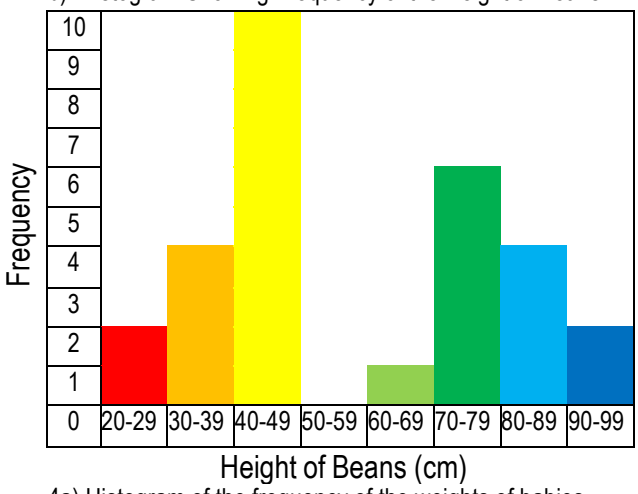
2a)



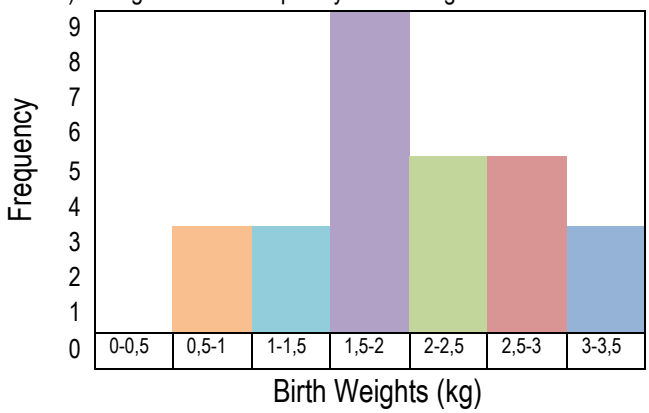
b) Gauteng

3a) Height of bean plants (cm)	Tally	Frequency
20 – 29	||	2
30 – 39	||||	4
40 – 49	𝍸 𝍸 |	10
50 – 59		0
60 – 69	|	1
70 – 79	𝍸 |	6
80 – 89	||||	4
90 – 99	||	2
Total	𝍸 𝍸 𝍸 𝍸 𝍸 ||||	29

b) Histogram Showing Frequency of the Height of Beans



4a) Histogram of the frequency of the weights of babies

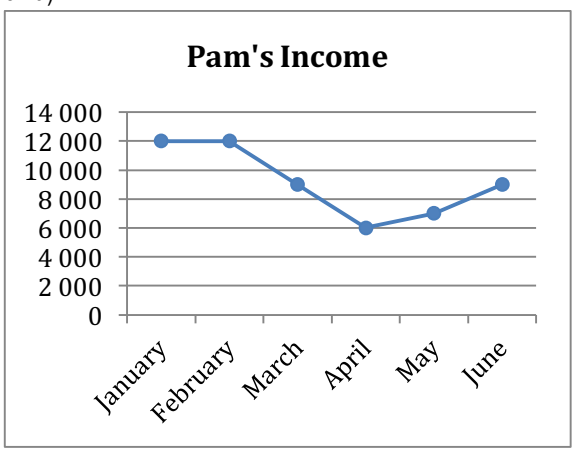


b) Mean = 2,0475 kg
Median = 1,95 kg

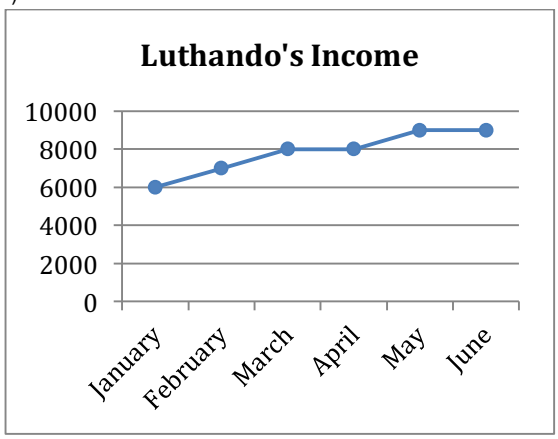
c) The mean of baby weights from the clinic is over 1 kg less than the average of the country.
The maximum weight of babies born at this clinic is 2,2kg lower than that of the rest of the country.
The median is also quite low. From this graph we can see that a large number of babies at this clinic weight between 1,5 kg and 2 kg at birth. This is well below the average birth rate for babies in the country generally.

Grade 9

5. a)

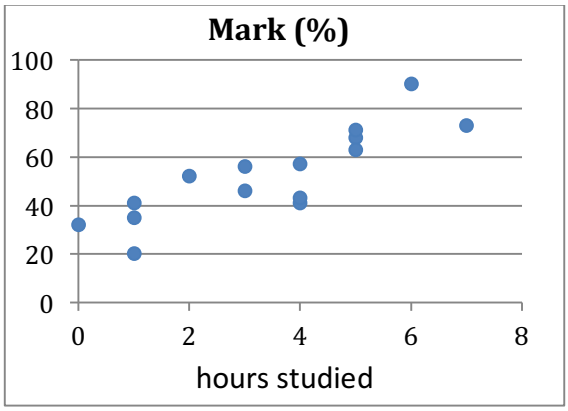


b)



c) Luthando's income

6. a)



b) Yes, the points have a positive weak linear correlation.

Unit 5.3: Bias and error in data

Grade 7 – 9

1a) Burger A

b) Yes, this is true.

2a) No

b) Any of the statistics except the mode can give us a better picture. For example, if the range is small, this might show that there are small differences between the salaries of the employees. The median would show what the highest pay of the bottom half of the earners at the company is. If it is a lot small than the mean it probably indicates that there are some large salaries at the upper end that are "pulling up" the mean. This information can be misleading. We assume that most staff earn something close to the mean (around R13 731). This is probably not true. It is most likely that a few staff members earn a very large salary compared to many staff members who earn a relatively small salary.

Grade 8 & 9

a) Two blocks on the graph represents 2,5%.
No, it is not a misleading graph.

b) You could increase the scale on the vertical axis and reduce the scale on the horizontal axis. An increased scale on the vertical axis would make the graph bigger and a reduced scale on the horizontal axis would make the graph steeper thus making the differences more noticeable.

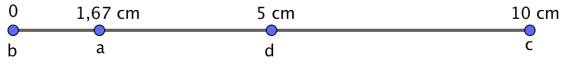
c) You would reduce the scale on the vertical axis and increase the scale on the horizontal axis. A reduced scale on the vertical axis would make the graph smaller and an increased scale on the horizontal axis would make the graph flatter thus making the differences less noticeable.

Unit 5.4: Probability

Grade 7, 8 and 9

1. a) $\frac{1}{6}$ b) $\frac{3}{6}=\frac{1}{2}$
   c) $\frac{3}{6}=\frac{1}{2}$ d) $\frac{0}{6}=0$
   e) $\frac{4}{6}=\frac{2}{3}$ f) $\frac{6}{6}=1$
2. a) $\frac{13}{52}=\frac{1}{4}$ b) $\frac{26}{52}=\frac{1}{2}$
   c) $\frac{12}{52}=\frac{3}{13}$ d) $\frac{4}{52}=\frac{1}{13}$
3. a) $\frac{6}{19}$ b) $\frac{10}{19}$
   c) $\frac{9}{19}$ d) $\frac{9}{19}$ e) $\frac{0}{19}=0$
4. a) $\frac{2}{8}=\frac{1}{4}$ b) $\frac{1}{8}$ c) $\frac{3}{8}$
5. a) $\frac{5}{725}=\frac{1}{145}$
   b) $\frac{10}{725}=\frac{2}{145}$
   c) $\frac{2}{725}$

6. a) $\frac{1}{6}=0{,}167$ b) No chance c) It has to happen
   d) 50% chance



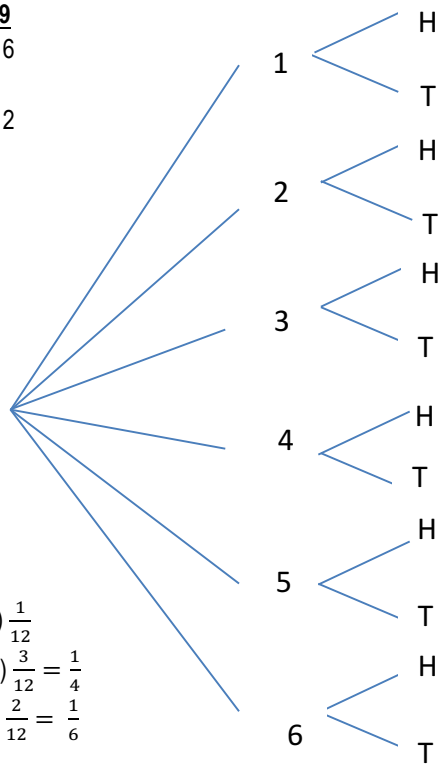
Grade 8 and 9

6. a) $\frac{1}{6}\times 300=50$
   b) $\frac{3}{6}\times 300=150$
   c) 0

7. $\frac{1}{6}\times 30=5$ Therefore it isn't what would be expected.
   It would be expected to roll a six 5 times out of thirty.

Grade 9

8. a) 6
   b) 2
   c)



   d) i) $\frac{1}{12}$
   ii) $\frac{3}{12}=\frac{1}{4}$
   iii) $\frac{2}{12}=\frac{1}{6}$

9.

x	a)	Second spinner			
First spinner		1	1	2	3
	2	3	3	4	5
	3	4	4	5	6
	4	5	5	6	7
	5	6	6	7	8

   b) 5 and 6 c) $\frac{2}{16}=\frac{1}{8}$

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