Mathematics

TEST & EXAM PREPARATION

Anne Eadie, Gretel Lampe & Tracy Howie

2-in-1

THE
ANSWER
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Grade 8 **Mathematics** 2-in-1 CAPS

TEST & EXAM PREPARATION

The Answer Series Grade 8 Maths 2-in-1 study guide walks you through the fundamentals of critical concepts such as algebra and geometry, helping you to build a thorough understanding of every topic. With this strong foundation, your logic and mathematical reasoning will develop profoundly.

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- Topic-based graded questions and full answers – to develop a step-by-step, thorough understanding of theory, techniques and concepts in every topic.
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Key features:

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THE ANSWER SERIES *Your Key to Exam Success*

Mathematics

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GRADE 8 MATHS COMPANION

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& Answer book

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1 Questions in Topics

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TERM 2: QUESTIONS

⑧ ALGEBRAIC EXPRESSIONS (Part 2)

Sum	➡	**+**	. . . Add
Difference	➡	**−**	. . . Subtract
Product	➡	**x**	. . . Multiply
Quotient	➡	**÷**	. . . Divide

Algebraic Language

Exercise 8.1
Answers on p. A33

1. Write algebraic expressions for the following statements, making the unknown number x.

   *Algebraic expressions can be used to translate word problems into Mathematics.*

   1.1 The **sum** of an unknown number and 7. (1)

   1.2 The **product** of an unknown number and 3. (1)

   1.3 The **difference** between a certain number and 8. (1)

   1.4 Two more than double a number. (2)

   1.5 The **quotient** of an unknown number and 5 is squared. (2)

   1.6 The **sum** of an unknown number and 5, is multiplied by 2. (2)

   1.7 Double the **sum** of an unknown number and y. (2)

   1.8 The **difference** between an unknown number squared and twice that same number. (2)

   1.9 The **difference** between an unknown number and 7 is divided by the square root of the same unknown number. (2)

   1.10 The **product** of an unknown number and y, decreased by 15. (2)

2. Give expressions for the following and simplify where possible:

Time (Seconds, Minutes, Hours)

   2.1 The number of minutes in 3 hours and 20 minutes. (2)

   2.2 The number of seconds in p minutes and 16 seconds. (2)

	C = **P**rice $\times$ **N**umber
△ C / P N	**P** = $\dfrac{\textbf{C}ost}{\textbf{N}umber}$
	N = $\dfrac{\textbf{C}ost}{\textbf{P}rice}$
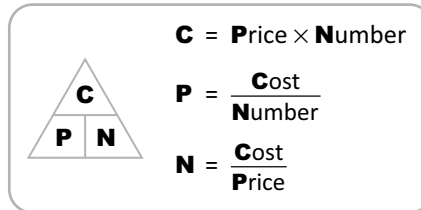
Cost

   2.3 The amount a customer will pay for 4 shirts that cost R80 each. (2)

   2.4 The amount a customer will pay for 2 pairs of jeans that cost m rands each with a discount of n rands per pair. (2)

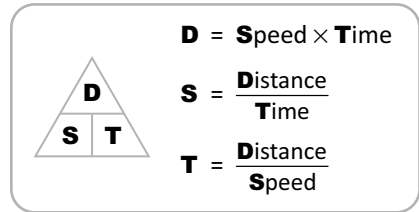   2.5 The amount a customer will pay for an item that costs R100 and has a discount of R20 per item. (2)

   2.6 The amount a customer will pay for 5 pairs of jeans that cost x Rand each, with a discount of R10 per pair. (2)

   2.7 The amount paid per banana if R20 was paid for a bag of 10 bananas. (2)

   2.8 The amount paid per apple if p rand is paid for a bag of q apples. (2)

Months & Years

   2.9 The number of months in 8 years and 5 months. (2)

   2.10 The number of months in t years and p months. (2)

Age

   2.11 A husband is 4 years older than his wife who is 45 years old. (2)

   2.12 A father is 28 years older than his son who is x years old. (2)

   2.13 A boy's sister is double his age. If he is 4 years old, how old is his sister? (2)

   2.14 A boy is double the age of his brother who is x years old. (2)

   2.15 The age of a person 5 years ago who is r years old now. (2)

   2.16 A girl is twice as old as her brother. He is x years old.

   Write down:
   (a) the girl's age
   (b) the age of her brother 5 years ago
   (c) the girl's age 5 years ago (3)

$$\begin{array}{c} D = \textbf{S}\text{peed} \times \textbf{T}\text{ime} \\ \textbf{S} = \dfrac{\textbf{D}\text{istance}}{\textbf{T}\text{ime}} \\ \textbf{T} = \dfrac{\textbf{D}\text{istance}}{\textbf{S}\text{peed}} \end{array}$$

Speed, Distance, Time

2.17 The distance a car travels in 1,5 hours if it travels at 100 km/h. (2)

2.18 The distance a car travels in x hours if it travels at y km/h. (2)

2.19 The speed a car is travelling if it goes m km in n hours. (2)

2.20 How long will it take a car to travel s km if it travels at v km/h. (2)

Rate

2.21 The amount of money earned if you are paid R20 an hour and you work for 6 hours. (2)

2.22 The amount of money earned if you are paid Rx an hour and you work for y hours. (2)

2.23 It takes one person 12 days to build a wall. How many days will it take 2 people to build the same wall? (2)

2.24 (a) A typist can type a document in 5 hours. How long will it take 2 typists to type the same document? (1)

(b) A typist can type a document in x hours. Write an expression for the time it would take 3 typists to type the same document. (1)

Simplifying Algebraic Expressions

Exercise 8.2 *Answers on p. A33*

1. If $A = 3x^2 + 5x - 2$; $B = -2x - x^2 + 7$; $C = -5 + 2x^2 + x$ determine the following:

   1.1 $A + C$ 1.2 $C - B$ (3)(4)

   1.3 the product of A and -2 (3)

2. Consider the following expressions:

   A: $3x^2 - 2 + 4x$

   B: $2x - 6x^2 + 5x^2$

   C: $4 - 2x^2 + 3x$

   2.1 Determine the value of $A + B + C$ (4)

   2.2 Determine $-3A$ (3)

3.1 Subtract $3x^2 - 2x - 7$ from $4x^2 - 2x - 6$. (3)

3.2 From $5 - 7y + y^2$, subtract $11 + 7y - 5y^2$. (3)

4. Determine the following:

   4.1 Divide $8x^5y^4 - 12x^2y^3 + 24x^4y^5$ by $-4x^2y^3$ (3)

   4.2 Multiply $3x^2y - 2xy^2$ by $-x^3y$ (2)

   4.3 Divide $-16a^3b^2 + 24ab - 8b^3$ by $-8ab$ (3)

   4.4 If $A = (2x - y)$, $B = 2$ and $C = (x + 3y)$, find and simplify $AB - C$. (4)

5. Given $P = 3m^2 - mn$ and $Q = m^2 - 2mn$, find

   5.1 $P - 3Q$ in terms of m and n. (3)

   5.2 x, if $x = 3(P - 3Q)$ and $m = -1$ and $n = 2$. (5)
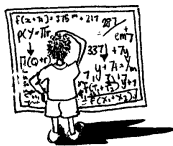

Consolidation of Algebraic Expressions

Exercise 8.3 *Answers on p. A34*

Simplify the following:

1. $3 \times a \times b$ (1)

2. $5p \times -3q$ (1)

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

4. $x^7 . x . x^2$ (2)

5. $7y^3z^4 \times 3y^3z$ (2)

6. $(4m^8)^2 \div 8m^{10}$ (3)

7. $4x^5y^4 \div (-2xy^3)$ (3)

8. $(a \times a \times a)^2 - 2(a \times a)^3$ (3)

9. $[-(2pq)^2]^3$ (3)

10. $(-2x^2)^3 \div 2$ (3)

11. $3 \times (a + b)$ (2)

12. $3x(x + 5)$ (2)

13. $-4x(x + 2y)$ (2)

14. $2p^2 - 3pq + 2qp - 2p$ (2)

15. $-7c - (-5c)$ (3)

16. $7 - m \times 3 + 7m$ (3)

17. $5a - 4(a + 1)$ (2)

18. $2ab + 2a(b + 3)$ (2)

19. $5(3m - 4n + 1)$ (3)
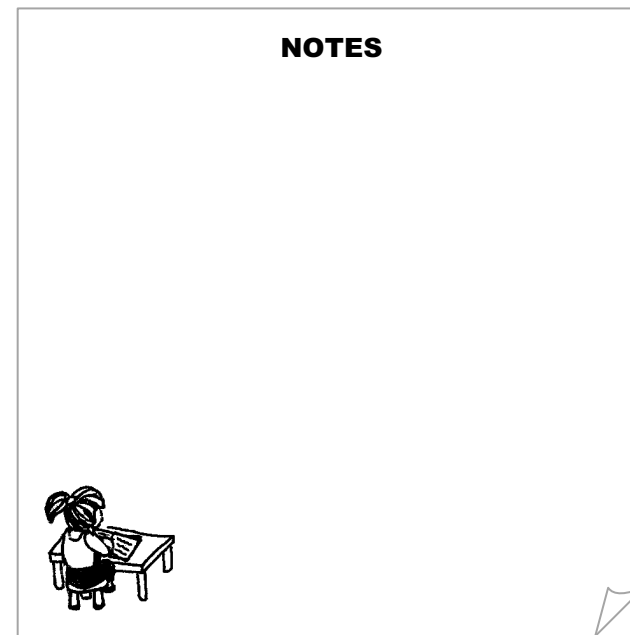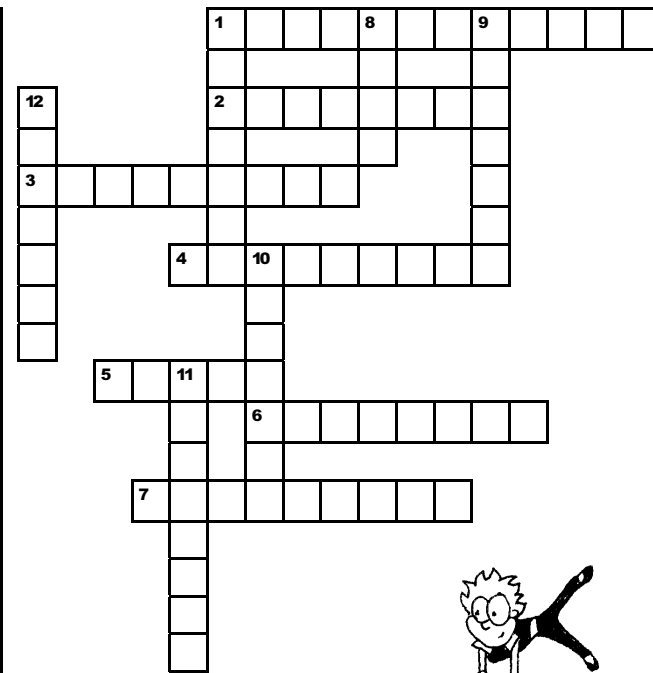
20. $-3mn(m^3 - m^2n + n^5)$ (3)

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21. $3x^2y(2xy^3 - 5xy^2 + xy)$ (3)

22. $+2a^2bc^3(2ab^2c + 2^2a^2bc^2 - 2^3abc)$ (3)

23. $(14x^3 - 21x) \div 7x$ (3)

24. $5 - 2(x + y) - (2y - 2x)$ (3)

25. $-3(2y - 3x) - 2(x + y)$ (3)

26. $-2(y - x)(-2) - (x - 3) - y$ (3)

27. $4ab^2 - 3b^2a + 2a \times (-3b)b - 2a$ (3)

28. $\dfrac{15p - 10q + 5pq}{5}$ (3)

29. $\dfrac{28m - 20mn}{4}$ (3)

30. $\dfrac{5a^2b - ab^3}{ab}$ (3)

31. $\dfrac{15a - 21}{-3a}$ (3)

32. $\dfrac{y^2 + y - 7y - 18y^3 + 11y^2}{6y}$ (4)

33. $x^2 \times x^0 + 2x - 2x^2$ (2)

34. $(-48t^4s - 12t^2s^5) \div (12ts)$ (3)

35. $\dfrac{(2 + 3)(x^2 + 3)}{15}$ (3)

36. $[(7y \times x)^2 + 7x^2y^2] \div 4xy^2$ (4)

37. $\sqrt{49x^{22}y^{16}}$ (2)

38. $\sqrt{25x^2 - 9x^2} \div 4x$ (3)

39. $\sqrt[3]{(8d^3)^2} - 3d(d + 2)$ (4)
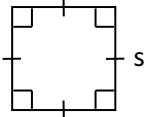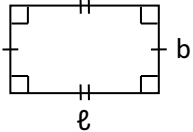
40. $\dfrac{12x \times 0}{3}$ (2)

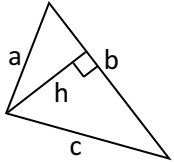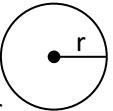
A fun puzzle
Answers on p. A35

Read the questions and complete the crossword puzzle.

Across

1. $2(x + y) = 2x + 2y$ shows the _____ law.

2. In an algebraic expression x is called a _____ .

3. $\{4; 6; 8; 9; 10; 12; 14; 15\}$ are _____ numbers from 1 to 15.

4. An algebraic expression with three terms is a _____ .

5. A number into which only one and itself can divide is a _____ number.

6. A number which can be written in the form $\dfrac{a}{b}$ where a and b are integers, is a _____ number.

7. $\dfrac{5 + 2 \times 6}{0}$ is _____ .

Down

1. The number you divide by to get a quotient is the _____ .

8. $Q \cup Q' = $ the set of _____ numbers.

Q = set of rational numbers
Q' = set of irrational numbers

9. Any fractions which are not equivalent fractions are _____ .

10. $\dfrac{1}{5}$ is the multiplicative _____ of 5.

11. 0 is the _____ element for addition.

12. $\{1; 2; 3; 6\}$ are the _____ of 6.

NOTES

2D Shapes	Perimeter (P)	Area (A)
	The **sum** of the **outer boundary lengths** of a 2D shape.	The **surface enclosed by** the **boundary lengths** of a 2D shape.
Square s = side	Perimeter = $4 \times$ side $\therefore$ **P = 4s**	Area = side $\times$ side = (side)^2 $\therefore$ **A = s²**
Rectangle ℓ = length b = breadth	Perimeter = $(2 \times$ length$) + (2 \times$ breadth$)$ $\therefore$ **P = 2ℓ + 2b** = **2(ℓ + b)**	Area = length $\times$ breadth $\therefore$ **A = ℓ $\times$ b**
Triangle a = side$_1$ b = base c = side$_2$ h = $\perp$ height	Perimeter = side$_1$ + base + side$_2$ $\therefore$ **P = a + b + c**	Area = $\frac{1}{2}$ base $\times \perp$h $\therefore$ A = $\frac{1}{2}$ b $\times \perp$h OR Area = $\frac{\text{base} \times \text{height}}{2}$ $\therefore$ **A = $\frac{\text{b x h}}{2}$**
Circle r = radius d = diameter = 2r	Circumference = $2 \times \pi \times$ radius OR = $\pi \times$ diameter (where $\pi = \frac{22}{7}$ or 3,14) $\therefore$ **C = 2πr** OR **C = πd**	Area = $\pi \times$ (radius)^2 $\therefore$ **A = πr²**

SI Units & Conversions

Small unit ➡ *big unit:* ÷

Big unit ➡ *small unit:* ×

Perimeter

divide ←

$\div 1\,000$ $\div 100$ $\div 10$

km   hm   dam   **m**   dm   **cm**   **mm**

$\times 1\,000$ $\times 100$ $\times 10$

multiply →

Area

divide ←

$\div (1\,000)^2$ $\div (100)^2$ $\div (10)^2$

km²   hm^2 dam^2 **m²**   dm^2 **cm²**   **mm²**

$\times (1\,000)^2$ $\times (100)^2$ $\times (10)^2$
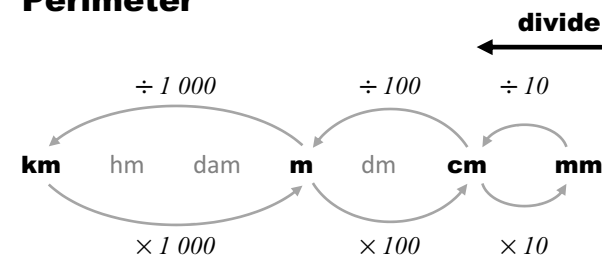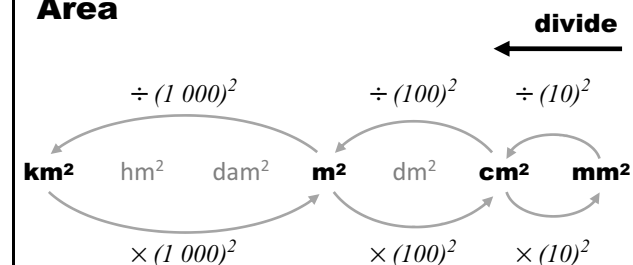
multiply →

Since the area is the product of **2D** *lengths, we need to* $\times$ *or* $\div$ *by the (conversion factor)*²*.*

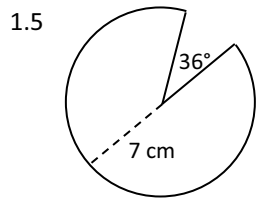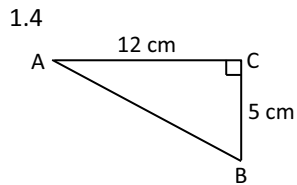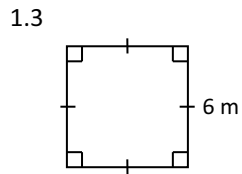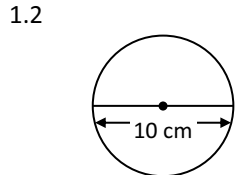**In calculations, always check that the units are the same.**

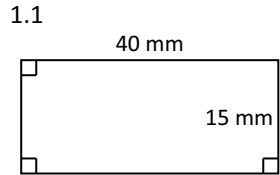*Copyright © The Answer Series: Photocopying of this material is illegal*

Area & Perimeter

Exercise 16.1

1. Find the area and perimeter of the following shapes:

1.1

40 mm

15 mm

1.2

10 cm

(4)(4)

1.3

6 m

1.4

12 cm

A

C

5 cm

B

(4)(6)

1.5

36°

7 cm

(8)

2. The following two pictures both have a frame with a width of 2 cm:

A:

20,5 cm

14 cm

B:

13 cm

18 cm
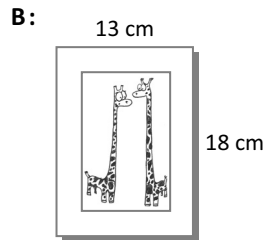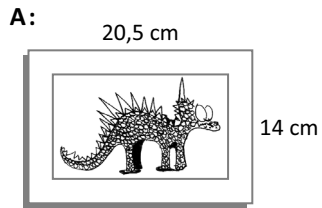
2.1 Which frame has the smallest perimeter? (4)

2.2 Which picture has the largest area? (6)

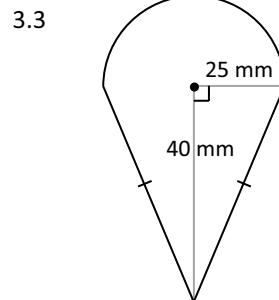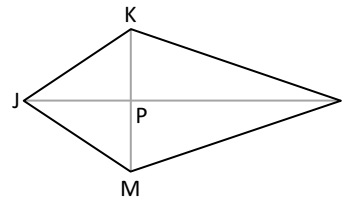3. Calculate the perimeter and area of the following shapes:
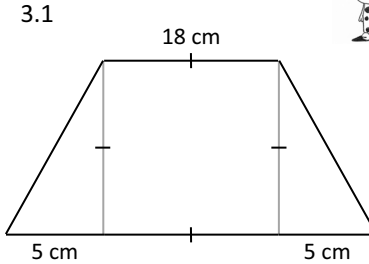
First calculate in the given unit (e.g. cm) and only convert to the asked units (e.g. mm²) in your final answer.

3.1

18 cm

5 cm   5 cm

Give your answers in mm and mm². (10)
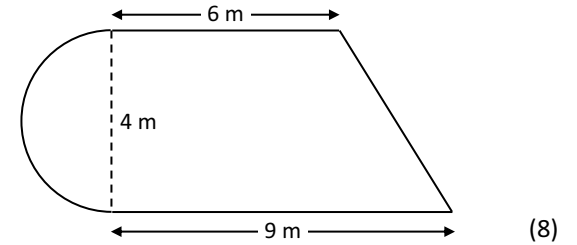
3.2 Kite JKLM has the following dimensions:

⊳ JK = 2 cm

⊳ LM = 3,5 cm

⊳ KM = 3 cm

⊳ JL = 4,5 cm

K

J

P

L

M

(8)

3.3

25 mm

40 mm

Give your answer in cm and cm². (12)

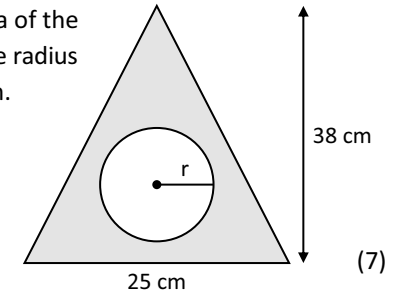4. The school decides to build a new swimming pool. If a swimming pool costs R2 100/m², how much will it cost the school to build the swimming pool?

6 m

4 m

9 m

(8)

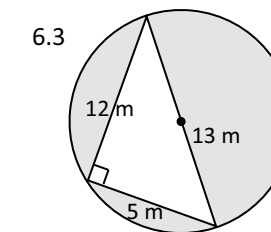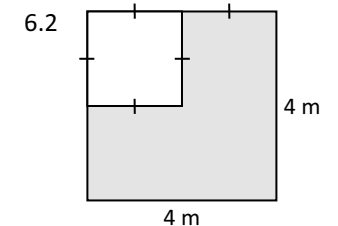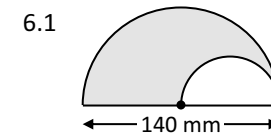5. Determine the area of the shaded region if the radius of the circle is 9 cm.

Give your answer in mm².

38 cm

r

25 cm

(7)

6. Calculate the area of the shaded parts in the shapes below:

6.1

140 mm

6.2
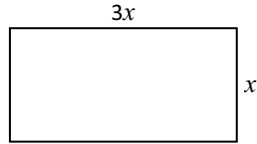
4 m

4 m

6.3

12 m

13 m

5 m

(18)

Solving problems using Area and Perimeter

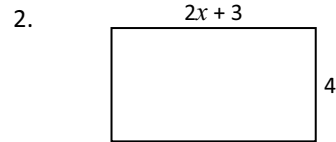### Exercise 16.2

Answers on p. A67

1. The area of the rectangle alongside is 48 cm².

   Determine the value of x. (4)

   3x

   x

2.

   2x + 3

   4

   Find algebraic expressions for:

   2.1 The area of the rectangle. (3)

   2.2 The perimeter of the rectangle. (3)

   2.3 If the area of the rectangle is 60 cm², find the value of x. (4)

3. If the area of a Compact Disc (CD) is 10 568 mm², calculate the radius of the CD. (Ignore the hole in the middle.) (4)

4. A circular rotating water spray covers an area of 12 m². How far away from the spray would you have to stand if you don't want to get wet? Round off your answer to the nearest metre. (6)

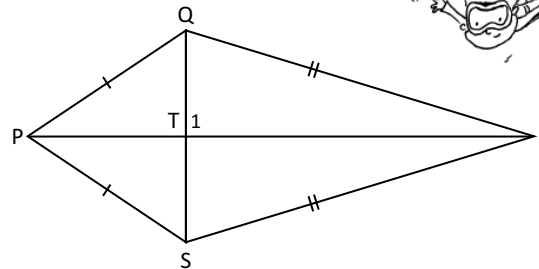5. The diagram below shows three circles, each with a diameter of 12 cm.

   Each vertex of the triangle is at the centre of a circle.
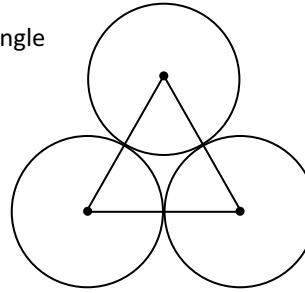
   What is the perimeter of the triangle? (4)

6. Given quadrilateral PQRS:

   Q

   T 1

   P   R

   S

   Refer to p. 37 (Q1.7) to refresh your memory!

   6.1 Name the quadrilateral PQRS, giving a reason for your answer. (2)

   6.2 $\hat{T}_1$ = _____

   Give a reason for your answer. (2)

   6.3 If PT = 8 cm and QS = 12 cm, calculate the length of PQ giving a reason. (6)

   6.4 Now, if TR = 2PT, calculate the perimeter of PQRS to the closest cm. (4)

   6.5 Calculate the area of quadrilateral PQRS. (5)

7. The Yin-Yang symbol below is made up of a black and a white section. The black teardrop shape is given as a sketch with dimensions.

   Determine the perimeter of this teardrop shape. Round the answer off to two decimal places.

   20 mm

   20 mm
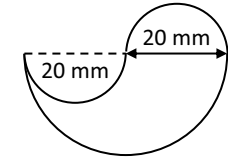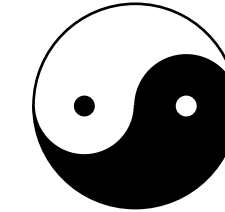
   (8)

8. The diagram alongside represents a rectangle. The perimeter of the rectangle is 37 cm.
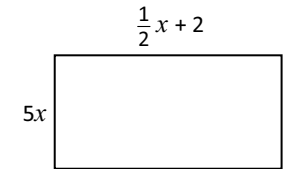
   The length and breadth are given in the diagram.

   What is the value of x in the diagram? (6)

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

   5x

9. The radius of a car's wheel is 42 cm.

   What distance, in kilometres, has the car travelled after 2 000 revolutions of the wheel? (7)

10. E

    F

    H

    G

    EF = 2EH (EF is twice the length of EH)

    If the perimeter of EFGH is 30 cm, calculate the length of FG. (Let EH be x) (6)

TERM 2: ANSWERS

8 ## ALGEBRAIC EXPRESSIONS (Part 2)

Sum	➡	**+**	. . . Add
Difference	➡	**−**	. . . Subtract
Product	➡	**×**	. . . Multiply
Quotient	➡	**÷**	. . . Divide

Algebraic Language

Exercise 8.1   *Questions on p. 26*

1.1 $x + 7$

1.2 $x \times 3 = 3x$

1.3 $x - 8$

1.4 $2x + 2$

1.5 $\left(\dfrac{x}{5}\right)^2$

1.6 $(x + 5) \times 2 = 2(x + 5)$

1.7 $2(x + y)$

1.8 $x^2 - 2x$

1.9 $\dfrac{x - 7}{\sqrt{x}}$

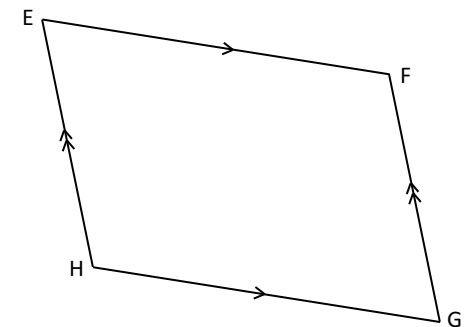1.10 $x \times y - 15 = xy - 15$

Time (Seconds, Minutes, Hours)

2.1   number of minutes $= 3 \times 60 + 20$
                             $= 180 + 20$
                             $= 200$ minutes

60 seconds in a minute

60 minutes in an hour

2.2   number of seconds $= p \times 60 + 16$
                             $= (60p + 16)$ seconds

Cost

2.3   amount $= 4 \times 80$
                   $= R320$

2.4 $2(m - n)$

2.5   amount $= 100 - 20$
                   $= R80$

2.6 $5(x - 10)$ Rand

2.7   amount per banana $= \dfrac{20}{10}$
                               $= R2$ per banana

2.8   amount per apple $= \dfrac{p}{q}$

Months & Years

2.9   number of months $= 8 \times 12 + 5$
                              $= 96 + 5$
                              $= 101$ months

2.10 number of months $= t \times 12 + p = 12t + p$

Age

2.11 husband's age $= 45 + 4$
                           $= 49$ years

2.12 father's age $= x + 28$

2.13 sister's age $= 2 \times 4$
                          $= 8$ years

2.14 boy's age $= 2 \times x$
                       $= 2x$ years

2.15 age of person 5 years ago $= (r - 5)$ years

2.16 (a) $2x$ years
       (b) $(x - 5)$ years
       (c) $(2x - 5)$ years

Speed, Distance, Time

2.17 Distance $= 1,5 \times 100$
                     $= 150$ km

2.18 Distance $= x \times y$
                     $= xy$ km

2.19 Speed $= \dfrac{m}{n}$ km/h

2.20 Time $= \dfrac{s}{v}$ hours

Rate

2.21 amount earned $= 20 \times 6$
                           $= R120$

2.22 amount earned $= x \times y$
                           $= Rxy$

2.23 $1 \times 12 = 12$
       $\therefore\ 2 \times 6 = 12$
       It will take 2 people 6 days to build the same wall.
       [The more people, the less time needed.]

2.24 (a) $2\dfrac{1}{2}$ hours   . . . $5 \div 2$ or $\dfrac{5}{2}$

       (b) $\dfrac{x}{3}$ hours

Simplifying Algebraic Expressions

Exercise 8.2   *Questions on p. 27*

1.1 $A + C$
      $= (3x^2 + 5x - 2) + (-5 + 2x^2 + x)$
      $= 3x^2 + 5x - 2 - 5 + 2x^2 + x$
      $= 5x^2 + 6x - 7$

1.2 $C - B$
      $= (-5 + 2x^2 + x) - (-2x - x^2 + 7)$
      $= -5 + 2x^2 + x + 2x + x^2 - 7$
      $= 3x^2 + 3x - 12$

1.3 $A \times -2$

$= -2A$

$= -2(3x^2 + 5x - 2)$

$= -6x^2 - 10x + 4$

2.1 $A + B + C$

$= (3x^2 - 2 + 4x) + (2x - 6x^2 + 5x^2) + (4 - 2x^2 + 3x)$

$= 3x^2 - 2 + 4x + 2x - 6x^2 + 5x^2 + 4 - 2x^2 + 3x$

$= 9x + 2$

2.2 $-3A = -3(3x^2 - 2 + 4x)$

$= -9x^2 - 12x + 6$

3.1 $4x^2 - 2x - 6$

$\underline{3x^2 - 2x - 7}$

$x^2 \qquad + 1$

3.2 $y^2 - 7y + 5$

$\underline{-5y^2 + 7y + 11}$

$6y^2 - 14y - 6$

4.1 $\dfrac{8x^5y^4 - 12x^2y^3 + 24x^4y^5}{-4x^2y^3}$

$= \dfrac{8x^5y^4}{-4x^2y^3} + \dfrac{-12x^2y^3}{-4x^2y^3} + \dfrac{24x^4y^5}{-4x^2y^3}$

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

4.2 $-x^3y(3x^2y - 2xy^2)$

$= -3x^5y^2 + 2x^4y^3$

4.3 $\dfrac{-16a^3b^2 + 24ab - 8b^3}{-8ab}$

$= \dfrac{-16a^3b^2}{-8ab} + \dfrac{24ab}{-8ab} + \dfrac{-8b^3}{-8ab}$

$= 2a^2b - 3 + \dfrac{b^2}{a}$

4.4 $AB - C$

$= (2x - y) \times 2 - (x + 3y)$

$= 2(2x - y) - (x + 3y)$

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

$= 3x - 5y$

5.1 $P - 3Q$

$= (3m^2 - mn) - 3(m^2 - 2mn)$

$= 3m^2 - mn - 3m^2 + 6mn$

$= 5mn$

5.2 $x = 3(P - 3Q)$

$= 3(5mn)$ ... $\boxed{P - 3Q = 5mn \text{ from } Q5.1}$

$= 15mn$

$= 15(-1)(2)$ ... $\boxed{\text{given } m = -1 \text{ and } n = 2}$

$= -30$

Consolidation of Algebraic Expressions

Exercise 8.3 *Questions on p. 27*

1. $3 \times a \times b = 3ab$

2. $5p \times -3q = -15pq$

3. $-(-3x)(-2x) = -6x^2$

4. $x^7 . x . x^2 = x^{7+1+2}$

$= x^{10}$

5. $7y^3z^4 \times 3y^3z$

$= 21y^6z^5$

6. $(4m^8)^2 \div 8m^{10}$

$= \dfrac{16m^{16}}{8m^{10}}$

$= 2m^6$

7. $4x^5y^4 \div (-2xy^3)$

$= \dfrac{4x^5y^4}{-2xy^3}$

$= -2x^4y$

8. $(a \times a \times a)^2 - 2(a \times a)^3$

$= (a^3)^2 - 2(a^2)^3$

$= a^6 - 2a^6$

$= -a^6$

9. $[-(2pq)^2]^3$

$= [-(4p^2q^2)]^3$

$= -64p^6q^6$

10. $(-2x^2)^3 \div 2$

$= \dfrac{-8x^6}{2}$

$= -4x^6$

11. $3 \times (a + b)$

$= 3a + 3b$

12. $3x(x + 5)$

$= 3x^2 + 15x$

13. $-4x(x + 2y)$

$= -4x^2 - 8xy$

14. $2p^2 - 3pq + 2qp - 2p$

$= 2p^2 - 3pq + 2pq - 2p$ ...

$= 2p^2 - pq - 2p$

$\boxed{\begin{array}{l} \textit{commutative law:} \\ p \times q = q \times p \end{array}}$

15. $-7c - (-5c)$

$= -7c + 5c$

$= -2c$

16. $7 - m \times 3 + 7m$

$= 7 - 3m + 7m$

$= 7 + 4m$

17. $5a - 4(a + 1)$

$= 5a - 4a - 4$

$= a - 4$

18. $2ab + 2a(b + 3)$

$= 2ab + 2ab + 6a$

$= 4ab + 6a$

19. $5(3m - 4n + 1)$

$= 15m - 20n + 5$

20. $-3mn(m^3 - m^2n + n^5)$

$= -3m^4n + 3m^3n^2 - 3mn^6$

21. $3x^2y(2xy^3 - 5xy^2 + xy)$

$= 6x^3y^4 - 15x^3y^3 + 3x^3y^2$

22. $+2a^2bc^3(2ab^2c + 2^2a^2bc^2 - 2^3abc)$

$= 4a^3b^3c^4 + 8a^4b^2c^5 - 16a^3b^2c^4$

23. $\dfrac{14x^3 - 21x}{7x}$

$= \dfrac{14x^3}{7x} - \dfrac{21x}{7x}$

$= 2x^2 - 3$
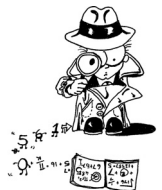
24. $5 - 2(x + y) - (2y - 2x)$
    $= 5 - 2x - 2y - 2y + 2x$
    $= 5 - 4y$

25. $-3(2y - 3x) - 2(x + y)$
    $= -6y + 9x - 2x - 2y$
    $= 7x - 8y$

26. $-2(y - x)(-2) - (x - 3) - y$
    $= (-2)(-2)(y - x) - (x - 3) - y$
    $= 4(y - x) - (x - 3) - y$
    $= 4y - 4x - x + 3 - y$
    $= 3y - 5x + 3$

27. $4ab^2 - 3b^2a + 2a \times (-3b)b - 2a$
    $= 4ab^2 - 3b^2a + 2ab(-3b) - 2a$
    $= 4ab^2 - 3ab^2 - 6ab^2 - 2a$
    $= -5ab^2 - 2a$

28. $\dfrac{15p - 10q + 5pq}{5}$
    $= \dfrac{15p}{5} - \dfrac{10q}{5} + \dfrac{5pq}{5}$
    $= 3p - 2q + pq$

29. $\dfrac{28m - 20mn}{4}$
    $= \dfrac{28m}{4} - \dfrac{20mn}{4}$
    $= 7m - 5mn$

30. $\dfrac{5a^2b - ab^3}{ab}$
    $= \dfrac{5a^2b}{ab} - \dfrac{ab^3}{ab}$
    $= 5a - b^2$

31. $\dfrac{15a - 21}{-3a}$
    $= \dfrac{15a}{-3a} - \dfrac{21}{-3a}$
    $= -5 + \dfrac{7}{a}$

32. $\dfrac{y^2 + y - 7y - 18y^3 + 11y^2}{6y}$
    $= \dfrac{-18y^3 + 12y^2 - 6y}{6y}$
    $= \dfrac{-18y^3}{6y} + \dfrac{12y^2}{6y} - \dfrac{6y}{6y}$
    $= -3y^2 + 2y - 1$

33. $x^2 \times x^0 + 2x - 2x^2$
    $= x^2 + 2x - 2x^2$
    $= -x^2 + 2x$

34. $(-48t^4s - 12t^2s^5) \div (12ts)$
    $= \dfrac{-48t^4s - 12t^2s^5}{12ts}$
    $= \dfrac{-48t^4s}{12ts} - \dfrac{12t^2s^5}{12ts}$
    $= -4t^3 - ts^4$

35. $\dfrac{(2 + 3)(x^2 + 3)}{15}$
    $= \dfrac{{}^1\!5(x^2 + 3)}{15_3}$
    $= \dfrac{x^2 + 3}{3} \left(= \dfrac{x^2}{3} + 1 \right)$

36. $[(7y \times x)^2 + 7x^2y^2] \div 4xy^2$
    $= (49x^2y^2 + 7x^2y^2) \div 4xy^2$
    $= \dfrac{56x^2y^2}{4xy^2}$
    $= 14x$

37. $\sqrt{49x^{22}y^{16}} = 7x^{11}y^8$

38. $\sqrt{25x^2 - 9x^2} \div 4x$
    $= \dfrac{\sqrt{16x^2}}{4x}$
    $= \dfrac{4x}{4x}$
    $= 1$

39. $\sqrt[3]{(8d^3)^2} - 3d(d + 2)$
    $= \sqrt[3]{64d^6} - 3d(d + 2)$
    $= 4d^2 - 3d^2 - 6d$
    $= d^2 - 6d$

40. $\dfrac{12x \times 0}{3}$
    $= \dfrac{0}{3}$
    $= 0$

A fun puzzle   *Questions on p. 28*

Crossword answers:
1. DISTRIBUTIVE
2. VARIABLE
3. COMPOSITE
4. TRINOMIAL
5. PRIME
6. RATIONAL
7. UNDEFINED
8. REAL
9. UNEQUAL
10. INVOLVE
11. IMDE
12. FACTORS
DIVISION
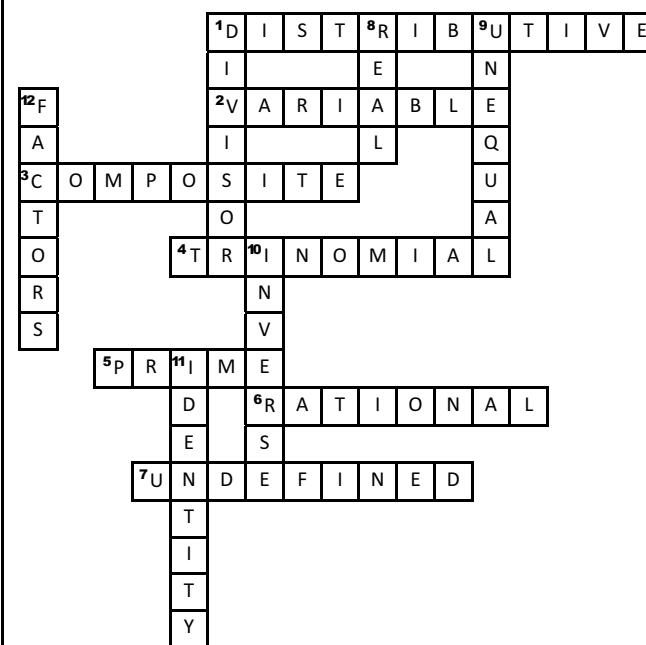
6. distance^2 + 10^2 = 12,5^2 . . . *Pythagoras*

∴ distance^2 = 12,5^2 − 10^2

= 156,25 − 100

= 56,25

∴ distance = $\sqrt{56,25}$

= 7,5 m

∴ the ladder will
need to be placed
7,5 m from the wall.

light

WALL

10 m   12,5 m

distance ?

---
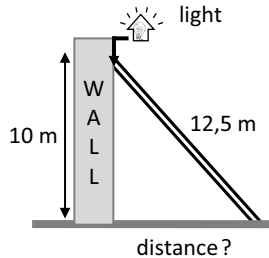
7. 12^2 + BC^2 = 15^2 . . . *Pythagoras*

∴ BC^2 = 15^2 − 12^2

= 225 − 144

= 81

∴ BC = $\sqrt{81}$

= 9 m

BD = BC + CD

∴ x = 9 m + 1,5 m

= 10,5 m

B

15 m

x

1,5 m   C

A   12 m   D
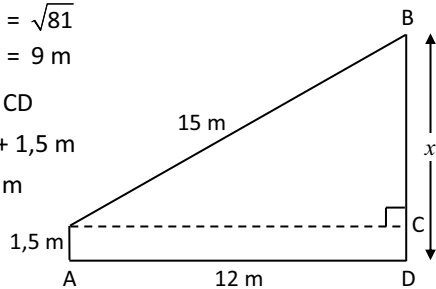
8.1 rectangle

8.2 Ĝ = Ĥ = Î = 90°

8.3 a right-angled triangle

8.4 GJ^2 + GH^2 = HJ^2 . . . *Pythagoras*

∴ 10^2 + 24^2 = HJ^2

∴ HJ^2 = 10^2 + 24^2

∴ HJ^2 = 100 + 576

∴ HJ^2 = 676

∴ $\sqrt{HJ^2}$ = $\sqrt{676}$

∴ HJ = 26 cm

---

16 # AREA & PERIMETER OF 2D SHAPES

Area & Perimeter

Exercise 16.1

1.1 Area = ℓ × b   &   Perimeter = 2ℓ + 2b

= 40 mm × 15 mm   = 2(40) + 2(15)

= 600 mm^2 = 80 + 30

= 110 mm

1.2 diameter = 10 cm ;   ∴ radius = 5 cm

∴ Area = πr^2 &   Perimeter = 2πr

= π(5)^2 = 2π(5)

= 78,54 cm^2 = 31,42 cm

> **OR** P = πd
> = π(10)
> = 31,42 cm

1.3 Area = s^2 &   Perimeter = 4s

= (6)^2 = 4(6)

= 36m^2 = 24 m

1.4 Area = $\frac{1}{2}$ b × ⊥h   **OR** Area = $\frac{b \times h}{2}$

= $\frac{1}{2}$ × 12 × 5   = $\frac{12 \times 5}{2}$

= 30 cm^2 = 30 cm^2

AB^2 = AC^2 + BC^2 . . . *Pythagoras*

AB^2 = 12^2 + 5^2

∴ = 144 + 25

= 169

AB = $\sqrt{169}$

= 13 cm

∴ Perimeter = a + b + c

= 12 + 5 + 13

= 30 cm

1.5 Fraction or sector of circle missing = $\frac{36°}{360°}$ = $\frac{1}{10}$

∴ Fraction of circle = $\frac{10}{10}$ − $\frac{1}{10}$ = $\frac{9}{10}$

∴ Area of $\frac{9}{10}$ of circle = $\frac{9}{10}$ × πr^2

= $\frac{9}{10}$ × π(7)^2

= 138,54 cm^2

Circumference of $\frac{9}{10}$ of circle = $\frac{9}{10}$ × 2πr

= $\frac{9}{10}$ × 2π(7)

= 39,58 cm

∴ Total circumference of shape

= circumference of $\frac{9}{10}$ of circle + 2 × radii

= 39,58 + (2 × 7)

= 53,58 cm

2.1 Frame A :   Frame B :

P = 2(ℓ + b)   P = 2(ℓ + b)

= 2(20,5 + 14)   = 2(18 + 13)

= 69 cm   = 62 cm

∴ Frame B has the smallest perimeter.

2.2 A :

2 cm

14 cm

2 cm   2 cm 2 cm
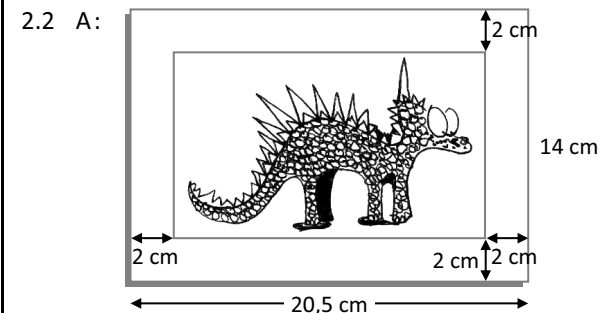
20,5 cm

∴ length of picture   breadth of picture

= 20,5 cm − 2 cm − 2 cm   = 14 cm − 2 cm − 2 cm

= 16,5 cm   = 10 cm

∴ Area of picture = ℓ × b

= 16,5 cm × 10 cm

= 165 cm^2

PAPER E1

All necessary working must be shown in its proper place with the answer.

No calculator may be used in this paper.

Diagrams are not necessarily drawn to scale.

QUESTION 1

Complete the table below.
Put ticks in the correct places to classify each number.

	Natural	Integer	Rational	Irrational	Real	Imaginary
-3						
4π						
$\sqrt{-7}$						
$\sqrt{36}$						

[4]

QUESTION 2   Remember:

2.1 Write down the lowest common multiple of 10 and 12. (1)

2.2 Which is bigger: $13{,}2$ or $\sqrt{163}$? (Explain your answer.) (1)

2.3 How many whole numbers lie between $\sqrt{8}$ and $\sqrt{80}$? (1)

2.4 Consider the numbers: -7 ; -5 ; -1 ; 1 ; 3
Using only two of the above numbers, what is the smallest product one could make? (1)

2.5 Write down the factors of 18. (2)

2.6 Simplify $\dfrac{10^7}{5 \times 10^4}$ (2)

2.7 $\diamond$ and Δ are natural numbers and $\diamond \times \Delta = 36$.
What is the largest possible value of $\diamond - \Delta$? (2)
[10]

QUESTION 3

3.1 Simplify:

3.1.1 $1\frac{1}{2} + 3\frac{2}{3}$ 3.1.2 $1\frac{5}{16} \div 2\frac{11}{12}$ (3)(3)

3.2 $n^{?}$ means the reciprocal of n.
So, $5^{?} = \dfrac{1}{5}$, for example.
Which of the following are true? Write down the letter(s) that correspond to all the correct statements.

A $3^{?} + 6^{?} = 9^{?}$

B $6^{?} - 4^{?} = 2^{?}$

C $2^{?} \times 6^{?} = 12^{?}$

D $10^{?} \div 5^{?} = 2^{?}$ (2)[8]

QUESTION 4

4.1 A pet shop sells only dogs, cats and mice in the ratio 2 : 3 : 30. If there are 385 animals in total, how many cats are there in the shop? (2)

4.2 Matthew began peeling a pile of 44 potatoes at a rate of 3 potatoes per minute. Four minutes later Charles joined him and peeled at a rate of 5 potatoes per minute.

When they finished, how many potatoes had Charles peeled? (3)

4.3 If $\dfrac{x}{y} = \dfrac{2}{3}$ and $\dfrac{y}{z} = \dfrac{7}{5}$ find the value of $\dfrac{z}{x}$.   (3)[8]

QUESTION 5

Given: $3x - 4x^2 + 2x^3 - 1$

5.1 What is the degree of the expression? (1)

5.2 What is the coefficient of x^3? (1)

5.3 Write down the constant term. (1)

5.4 What is the value of the expression if $x = 1$? (1)

5.5 Rearrange the expression in descending powers of x. (1)[5]

QUESTION 6

Simplify:

6.1 $-4x + 6x - x$ (1)

6.2 $-6x^2 - (-x^2)$ (1)

6.3 $-4(x + 2y)$ (2)

6.4 $\sqrt[3]{27x^{27}}$ (2)

6.5 $-3x^2y \times 4xy^3$ (2)

6.6 $-(2x^2)^3$ (2)

6.7 $\dfrac{4x^4}{16x^{16}}$ (2)

6.8 $3x - x(2x + 1)$ (2)

6.9 $\dfrac{6x^3 \times (-4x^2)}{-12x} - (2x)^4$ (4)[18]
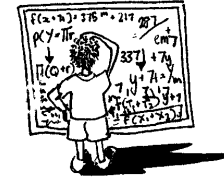
QUESTION 7

7.1 If $a = -2$, which is the largest number in the set
$$\left\{ -3a ; \ 4a ; \ \frac{24}{a} ; \ a^2 ; \ 1 \right\} ?$$ (2)

7.2 Subtract: $3x - 4y - z$
             $\underline{-x - 3y + z}$ (3)

7.3 Multiply: $-5xy^2(4x^3 - xy^3)$ (2)

7.4 Divide: $\dfrac{9x^3y^2 - 27xy^4}{-9xy^2}$ (2)[9]

   E11
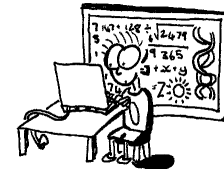
PAPER E1

1½ hours
100 marks

Remember: NO CALCULATOR

1.

	Natural	Integer	Rational	Irrational	Real	Imaginary
-3		✓	✓		✓	
4π				✓	✓	
$\sqrt{-7}$						✓
$\sqrt{36}$	✓	✓	✓		✓	

2.1 60 ◄ . . . *$10 = 2 \times 5$ and $12 = 2^2 \times 3$*
∴ LCM = $2^2 \times 3 \times 5$
*OR 10, 20, 30, 40, 50, **60**, 70, . . .*
*12, 24, 36, 48, **60**, 70, . . .*

2.2 [Note: **No calculator** allowed!]

$\sqrt{169} = 13$ . . . *$13^2 = 169$*

∴ $\sqrt{163} < 13$

∴ 13,2 is bigger than $\sqrt{163}$ ◄

2.3 $\sqrt{8} < \sqrt{9} = 3$ and $\sqrt{80} < \sqrt{81} = 9$

∴ The whole numbers between $\sqrt{8}$ and $\sqrt{80}$ are:
3 ; 4 ; 5 ; 6 ; 7 ; 8

∴ The **number** of whole numbers **= 6** ◄ . . . *Be sure to answer the question!*

2.4 The smallest product
$= (-7) \times 3 = -21$ ◄ . . . *Trial & error*

The smallest will be the number furthest left on the number line!

2.5 $F_{18} = 1 ; 2 ; 3 ; 6 ; 9 ; 18$ ◄

2.6 $\dfrac{10^7}{5 \times 10^4} = \left[\dfrac{10 \times 10 \times 10 \times \cancel{10} \times \cancel{10} \times \cancel{10} \times \cancel{10}}{5 \times \cancel{10} \times \cancel{10} \times \cancel{10} \times \cancel{10}}\right]$

$= \dfrac{10^3}{5}$

$= \dfrac{1\,000}{5}$

$= 200$ ◄

2.7 $36 - 1$
$= 35$ ◄ . . . *Possibilities: 36 & 1 ; 18 & 2 ; 12 & 3 ; 9 & 4 ; 6 & 6*

3.1.1 $1\dfrac{1}{2} + 3\dfrac{2}{3}$

$= \dfrac{3}{2} + \dfrac{11}{3}$

$= \dfrac{9 + 22}{6}$

$= \dfrac{31}{6}$

$= 5\dfrac{1}{6}$ ◄

3.1.2 $1\dfrac{5}{16} \div 2\dfrac{11}{12}$

$= \dfrac{21}{16} \div \dfrac{35}{12}$

$= \dfrac{\overset{3}{\cancel{21}}}{\underset{4}{\cancel{16}}} \times \dfrac{\overset{3}{\cancel{12}}}{\underset{5}{\cancel{35}}}$

$= \dfrac{3 \times 3}{4 \times 5}$

$= \dfrac{9}{20}$ ◄

3.2

A: $\dfrac{1}{3} + \dfrac{1}{6} = \dfrac{2}{6} + \dfrac{1}{6} = \dfrac{3}{6} = \dfrac{1}{2} \neq \dfrac{1}{9}$

B: $\dfrac{1}{6} - \dfrac{1}{4} = \dfrac{2}{12} - \dfrac{3}{12} = -\dfrac{1}{12} \neq \dfrac{1}{2}$

C: $\dfrac{1}{2} \times \dfrac{1}{6} = \dfrac{1}{12} = 12^{☐}$ ✓

D: $\dfrac{1}{10} \div \dfrac{1}{5} = \dfrac{1}{10} \times \dfrac{5}{1} = \dfrac{1}{2} = 2^{☐}$ ✓

C and **D** are true ◄

4.1 The number of cats $= \dfrac{3}{2 + 3 + 30}$ of 385

$= \dfrac{3}{\underset{1}{\cancel{35}}} \times \dfrac{\overset{11}{\cancel{385}}}{1}$

$= \dfrac{3 \times 11}{1 \times 1}$

$= 33$ ◄

4.2 *Hint: Draw a diagram!*

44 potatoes to be peeled

Minutes	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th
Potatoes peeled by:											
Matthew	3	3	3	3	3	3	3	3	3	3	3
Charles					5	5	5	5	5	5	5
Total peeled	3	6	9	12	20	28	36	44			

Number of potatoes which Charles peeled $= 4 \times 5 = 20$ ◄

Note: The total of 44 potatoes were peeled by the 8th minute.

OR Number of potatoes peeled

▶ in the 1st 4 minutes: $4 \times 3 = 12$ . . . *Matthew*

▶ & thereafter:
$3 + 5 = 8$ per minute . . . *Matthew & Charles*
for the remaining
$44 - 12 = 32$ potatoes

∴ 4 minutes . . . *$\dfrac{32 \text{ potatoes}}{8 \text{ per min}}$*

∴ Number of potatoes Charles peeled $= 4 \times 5 = 20$ ◄

4.3 $\dfrac{x}{\cancel{y}} \times \dfrac{\cancel{y}}{z} = \dfrac{2}{3} \times \dfrac{7}{5}$ . . . *Note the possibility of 'removing' y by cancelling.*

∴ $\dfrac{x}{z} = \dfrac{14}{15}$

∴ $\dfrac{z}{x} = \dfrac{15}{14}$ ◄ *If fractions are equal then their inverses are equal.*