

Tutorial letter 201/1/2015

MATHEMATICS AND MATHEMATICS TEACHING PST201F

Semester 1

Department Mathematics Education

IMPORTANT INFORMATION:

This tutorial letter contains the memorandum for Assignment 02

IMPORTANT INFORMATION:

At the end of this letter, you will find exam guidance.

BAR CODE

ASSIGNMENT 02

SOLUTIONS AND COMMENTS

Dear student

This tutorial letter contains solutions to Assignment 02. You will need to compare the solutions to your own attempts. This feedback is very important. Work through the solutions, and use the examples to prepare for the exam.

REMEMBER

NOT every question will be marked. That does not mean that the questions not marked are not important (Interpret the three NOTS in this sentence!!*). Look carefully at the marking schedule and the marks you obtained.

We are committed to help you to pass this module. Please be committed from your side to pass. Success will not come without effort.

*It means everything is important!

The solutions are placed in boxes for your convenience

PART A

Activity 1.1

Write a short paragraph on your experiences as a learner in a Mathematics class when you were at school. Write at least one good experience and one bad experience.

(5)

Own ideas

Activity 1.2

Write a paragraph to describe what you think **each** of the pictures (photos) represent. Do not rush though the activity. Write **as much as you can** about the situation depicted in each picture.

(10)

Own ideas:

Some students' opinions (students give their own impressions)

- 1 Teacher stand behind her table, children all listen passively to the teachers
- 2 Learners are engaged in a problem, where they have manipulatives (concrete apparatus which they can use to solve a problem)
- 3 Looks like a very old classroom set-up. One can almost smell the fear of the children – sitting on their hands!
- 4 Teacher listening attentively to learners

- | | |
|---|--|
| 5 | Learners sitting alone, grappling with mathematics – not a happy picture |
| 6 | I can feel the enthusiasm with which learners are listening to teachers. Learners actively engaged in the lesson |

Activity 1.3

- 3 Describe the role of the teacher and the learners in a classroom where they are doing mathematics. (5)

Teachers:

- Create an environment for doing math
- Mutual respect for each other and other opinions
- Not criticize if make mistakes – allow learners to defend their opinions
- Listen attentively

Learners: (verbs in text book, e.g. explore, verify, solve, predict, etc)

- Actively involved
- Must make sense of concepts through discussion
- Discover through logical reasoning
- Must be willing to take risks

Activity 1.5

Turn to page 18 of your prescribed textbook.

Read the instructions and answer the question:

- 1 *Who has the best chance of getting a red and a blue?*

Now answer the following questions:

- 2 *Was there a rule that you could follow to answer the question?*

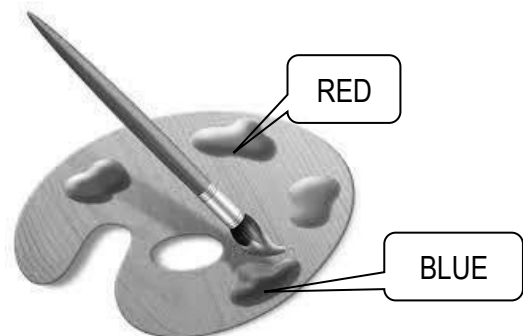
There was no "rule" to be followed

- 3 *Did you make up your own strategy?*

Own answer

- 4 *How do you feel about solving a problem without somebody giving you the "rule" to work with?*

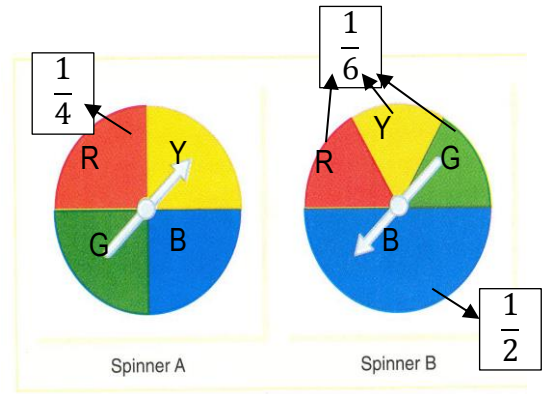
Own answer



If you mix blue paint with red paint, you will have purple.

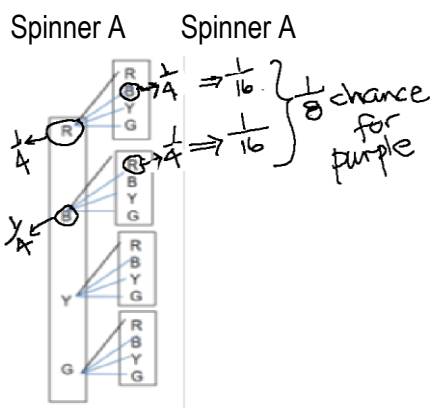
Here is the problem and some solutions

Three students are spinning to get purple with two spinners, either by spinning first red and then blue, or first blue and then red. They may choose to spin each spinner once, or one of the spinners twice. Mary chooses to spin twice on spinner A, John chooses to spin twice on spinner B, and Susan chooses to spin first on spinner A and then on spinner B. Who has the best chance of getting a red and a blue?

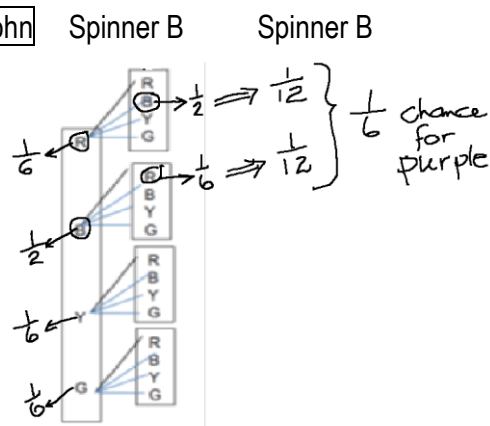


A solution

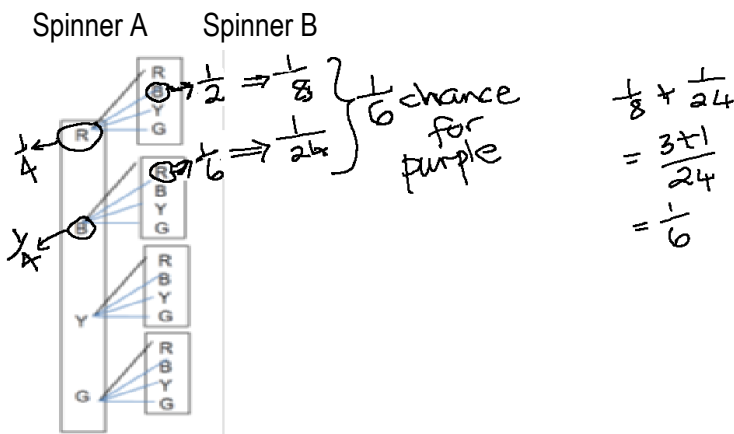
Mary



John



Susan



$$\begin{aligned} \frac{1}{8} + \frac{1}{24} \\ &= \frac{3+1}{24} \\ &= \frac{1}{6} \end{aligned}$$

Another strategy is explained on page 19 of the text book.

If you use a square to indicate each of the possibilities as a fraction part, then it will look as follows:

MARY

SPINNER A

RED	BLUE	GREEN	YELLOW
-----	------	-------	--------

SPINNER A

RED
BLUE
GREEN
YELLOW

SPINNER A overlaps with itself

RR	RB	RG	RY
BR	BB	BG	BY
GR	GB	GG	GY
YR	YB	YG	YY

The square is divided into 16 parts of equal size.

Two of the parts are both red and blue.

$$\frac{2}{16} = \frac{1}{8}$$

There is one-eighth chance of getting purple.

If you superimpose the one square (SPINNER A) over itself, you can see which parts overlap. Can you see the parts that are "purple"?

SUSAN

SPINNER A

RED
BLUE
GREEN
YELLOW

SPINNER B

BLUE
BLUE
BLUE
YELLOW
GREEN
RED

SPINNERS A AND B OVERLAPPING

BR	BB	BG	BY
BR	BB	BG	BY
BR	BB	BG	BY
YR	YB	YG	YY
GR	GB	GG	GY
RR	RB	RG	RY

The square is divided into 24 parts of equal size. Four of the parts are both red and blue.

$$\frac{4}{24} = \frac{1}{6}$$

There is one-sixth chance of getting purple.

If you superimpose the one square (SPINNER A) over the other (SPINNER B) you can see which parts overlap. Can you see the overlapping parts?

JOHN

If you superimpose the one square (SPINNER B) over a duplicate of itself you can see which parts overlap. Let us see which parts will be blue as well as red (BR):

SPINNER B

BLUE
BLUE
BLUE
YELLOW
GREEN
RED

SPINNER B

BLUE
BLUE
BLUE
YELLOW
GREEN
RED

SPINNER B overlaps with itself

BB	BB	BB	BY	BG	BR
BB	BB	BB	BY	BG	BR
BB	BB	BB	BY	BG	BR
YB	YB	YB	YY	YG	YR
GB	GB	GB	GY	GG	GR
RB	RB	RB	RY	RG	RR

The square is divided into 36 parts of equal size. Six of the parts are both red and blue.

$$\frac{6}{36} = \frac{1}{6}$$

There is one-sixth chance of getting purple.

Activity 1.11

- 1 Explain the difference between relational understanding and instrumental understanding. (2)

Bookwork. See textbook and tut letter 501

Relational understanding is an understanding of what to do AND WHY. All concepts are in a connected network and when a learner wants to recall a concept, all the other related concepts are understood and can easily be recalled.

Instrumental understanding is on the opposite continuum of understanding. This is also called "doing without real understanding". The ideas are isolated, and cannot be connected (related) to other ideas. Instrumental understanding is related to the rote learning of concepts.

Activity 2.3

Select any of the strategies discussed on page 56 to solve the following problems. You must describe in your own words how you are using the strategy.

Problem 1

Jack and Jill were at the same spot at the bottom of the hill, hoping to fetch a pail of water. They both began walking up the hill. Jack walks 5 metres every 25 seconds, and Jill walks 3 metres every 10 seconds*. They walk at a constant rate. Who will get the pail of water first? (*Misprint in Ass 02)

Draw a table (you can use your own strategy)

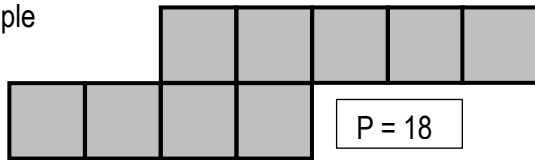
Seconds	5	10	15	20	25
Jill (distance, m)	1,5	3	4,5	6	7,5
Jack (distance, m)	1	2	3	4	5

Jill walks faster than Jack, She will get there first

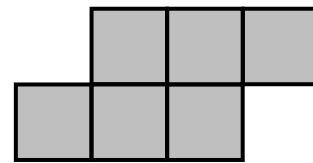
Problem 2

In the diagram alongside, assume that the edge of each square is 1 unit. Add squares to this shape so that the perimeter (the distance around the entire shape) is 18 units.

One example



P = 18



P = 12

There are many more than one ways to do this.

Activity 2.4

Here are some examples of routine and non-routine questions. Which is which? Why do you say that?

Find the solutions to each of the questions, and explain your own thinking processes.

You might find some of the questions problematic. Do not worry about that, but give your best. Just try to do them to the best of your knowledge. Be honest when you write about your own experience when writing up your solutions.

- 1 Round off 34,56 to the nearest one decimal place.

Usually teachers teach the rule for rounding off.

The "rule": If you have to round off to the nearest tenth (one decimal), then look at the digit in the hundredth place. If it is 5, 6, 7, 8 or 9. Then you must round up. If the hundredth digit is less than 5, then the tenth digit stays the same. So this is really a routine problem.

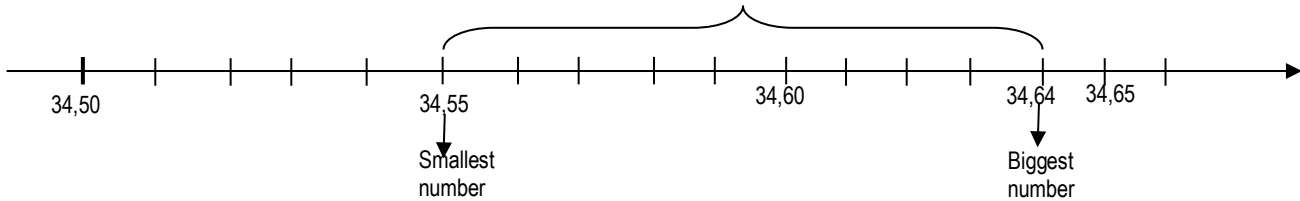
- 2 Which numbers, when rounded off, becomes 34,6? What are the **largest** and **smallest** possible numbers?

This is more of a non-routine problem. It is different from the usual question teachers ask about rounding off.

This question does not require you to round off, but to think about the possible values in the hundredth place value, that will round off to 34,6.

Now we can think about the position of 34,6 on the number line.

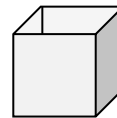
(2)



All numbers between 34,55 (inclusive) and 34,64 (inclusive) can be rounded off to 34,6

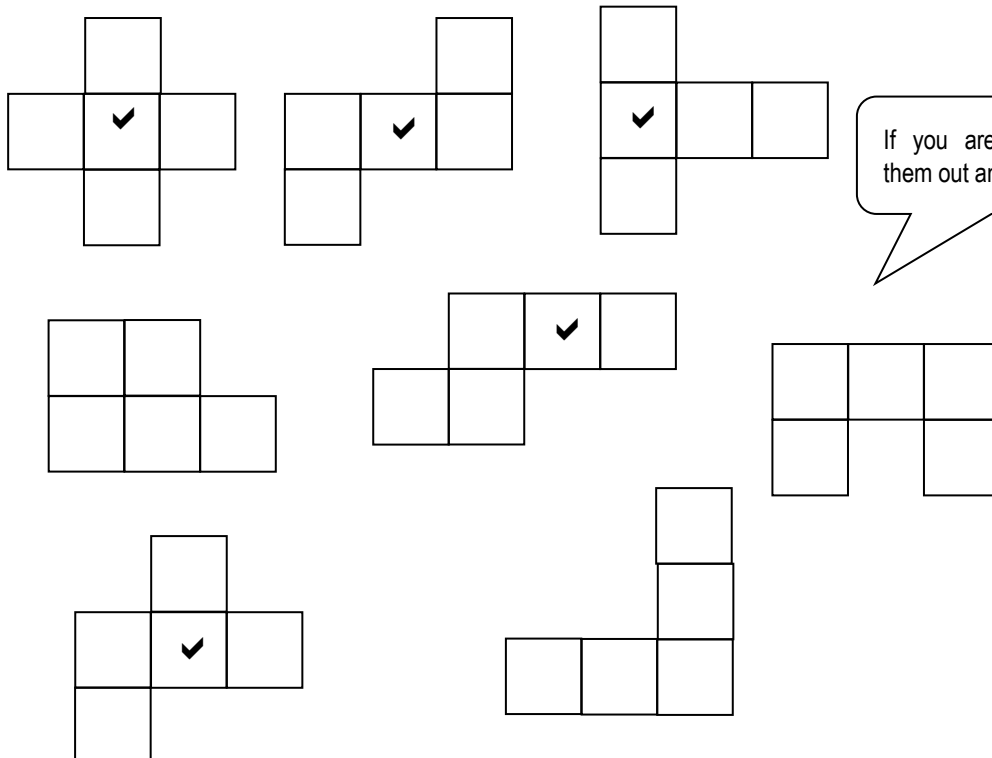
Activity 2.5

This is a drawing of a cube without a top (called an open cube).



- 1 Which of the nets can be folded to make this box? Redraw these in your script.

(3)



Activity 2.6

- 1 What does it mean to say that a task has multiple entry points?

A problem where different strategies can be used to find a solution, is called a problem with multiple entry points

- 2 Write down any mathematical task for intermediate phase learners where you can use at least two entry points.

Example

Joseph has 24 marbles, some red and some blue. He gives all the red marbles to Janet. Janet says she wants to exchange half of her red marbles for blue marbles. They do that, and now Joseph has 18 marbles left. How many red marbles are there?

(5)

Activity 2.7

- 1 Give reasons why there should be a shift in the thinking about mathematics teaching.

Think about:

Mathematics should not been seen as learning a set of rules and procedures. A variety of methods to solve the same problem should be encouraged. Learners should be given good problems and not just repetitive exercises of the same kind.

- We want to move away from procedural knowledge to conceptual understanding of mathematics.
- Learners should do less rote learning of rules and become more involved in making sense of concepts
- There should be more classroom discussion to enhance understanding
- Learners have to be given the opportunity to voice their opinions about how they understand and solve problems
- Teacher must LISTEN to learners to understand how they think and reason
- Learners should not be criticized for making mistakes.

- 2 Use your own words to describe the teacher's actions in the *before*, *during* and *after* phases of a problem-solving lesson. USE OWN WORDS

(6)

See the three stages in tut letter 501 and in text book page

PART B

These questions relate to Chapter 11 - 13 of the prescribed books:

- 1 Name the three ways one can count a set of objects, and explain how these methods of counting can be used to combine concepts and written names for numbers. (6)

See pages 191 and 208 van de Walle

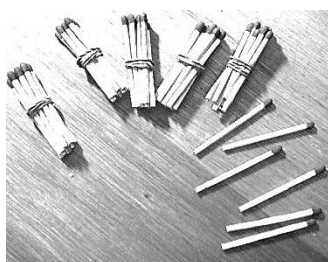
- 2 Describe two types of physical models for base-ten concepts. What is the significance of the differences between these models? (4)

See tutorial letter 102 page 7

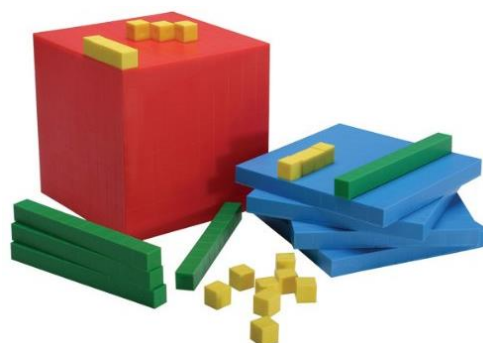
Beans – see packaging



Match sticks – bundles of 10



Dienes blocks



Now DESCRIBE in your own words

- 3 Describe two ways in which the hundred chart can be used to identify place value. (2)

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

- In the rows, the unit digits grow by 1 as you move from left to right.
- The last column has all unit digits as zero, but the tens digits increase by one as you move down.
- In the columns, the tens digit grows by one as you go down.
- The last number in the chart is 100

H	T	U
1	0	0

place value chart

Examples

Remember place values:

H T U

MUST refer to place values

The rows show the same face values in the tens place value (except for the last column)

The columns show the same face values in the unit place value

In column 1 All unit digits are 1 – we have always 1 in the unit place value

In column 2, all unit digits are 2, etc.

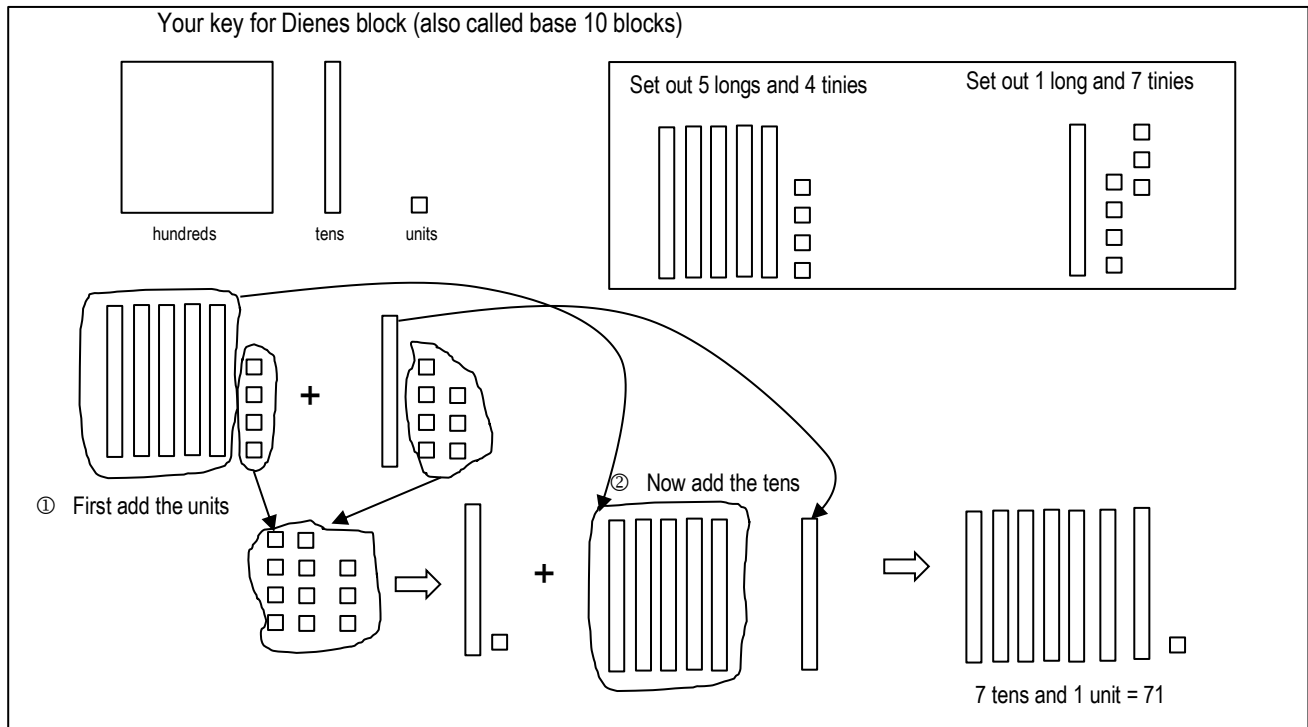
In row one (except for last block) all the numbers are only one digit, so they are in the ones place

In row two (except for last block) all the place values of the tens digits is 1

Try to find more patterns in the place values.

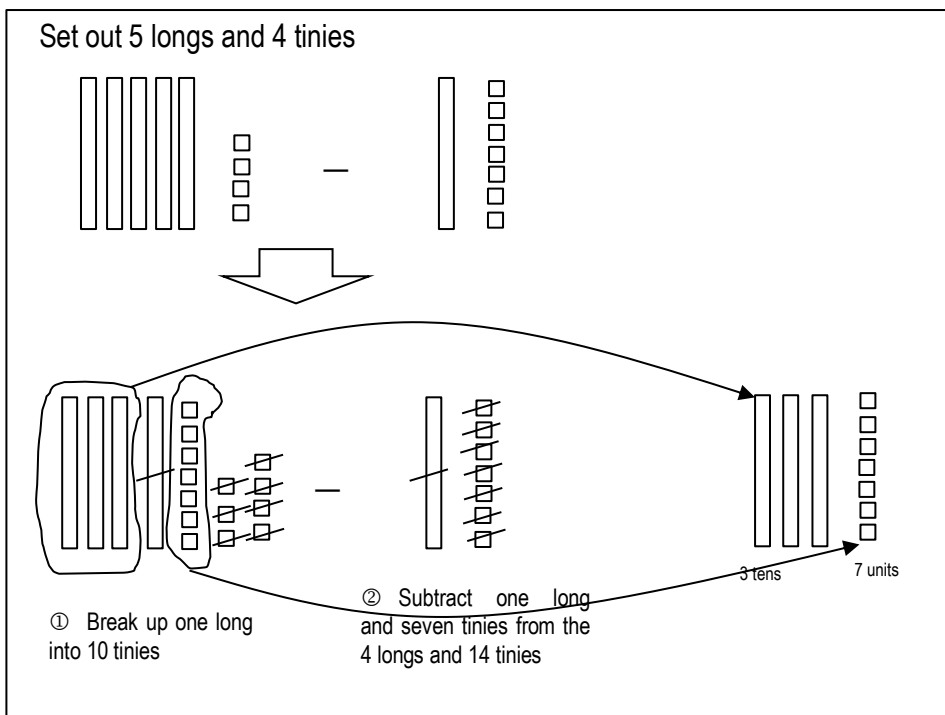
4 Draw Dienes block to show how to find the solution to:

a) $54 + 17$



b) $54 - 17$

(6)



5 Test the following numbers for divisibility by 9, and 11. (Do not factorise – no calculator)

a) 11 183 139

Add the digits: $1+1+1+8+3+1+3+9 = 27$, which is divisible by 9,
so 11 183 139 is divisible by 9

① Add every second digit: $1+8+1+9= 19$

② Add the other digits $1+1+3+3=8$

③ Subtract: $19 - 8 = 11$ (11 or 0)

11 183 139 is divisible by 11

b) 175 202 511

Neither divisible by 9, nor by 11 (test for both)

$175\ 202\ 511 = 29 \times 113 \times 239 \times 2237$ (four prime factors)

(3)

6 The Sieve of Eratosthenes is a well-known way to find prime numbers. In this example, you must find all the prime numbers between 1 and 100.

NOT SHOWN HERE

(5)

7 Use the vertical and horizontal algorithms to find the sum or difference of: (Explain the "borrow" and "carry" concepts)

a) $283 + 197$

② This small 1 here is 1 hundred

① Add the units: $3 + 7 = 10$. This small 1 here is 1 ten

$$\begin{array}{r} 12\ 8\ 3 \\ +\ 1\ 9\ 7 \\ \hline 4\ 8\ 0 \end{array}$$

$$\begin{aligned} 283 + 197 &\Rightarrow 200 + 80 + 3 + 100 + 90 + 7 \\ &= 200 + 100 + 80 + 90 + 3 + 7 \\ &= 300 + 170 + 10 \\ &= 300 + 100 + 70 + 10 \\ &= 400 + 80 = 480 \end{aligned}$$

Some steps may be left out

b) $283 - 197$

① Borrow 1 ten from the 80. Eighty becomes 70 and the 3 becomes 13

② Now borrow 100 from the 200. The 70 now becomes 170

$$\begin{array}{r} 12\ 17\ 8\ 13 \\ -\ 1\ 9\ 7 \\ \hline 8\ 6 \end{array}$$

(3)

8 How are standard algorithms different from student-invented strategies? Explain the benefits of invented strategies over standard algorithms (give at least two valid points).

(2)

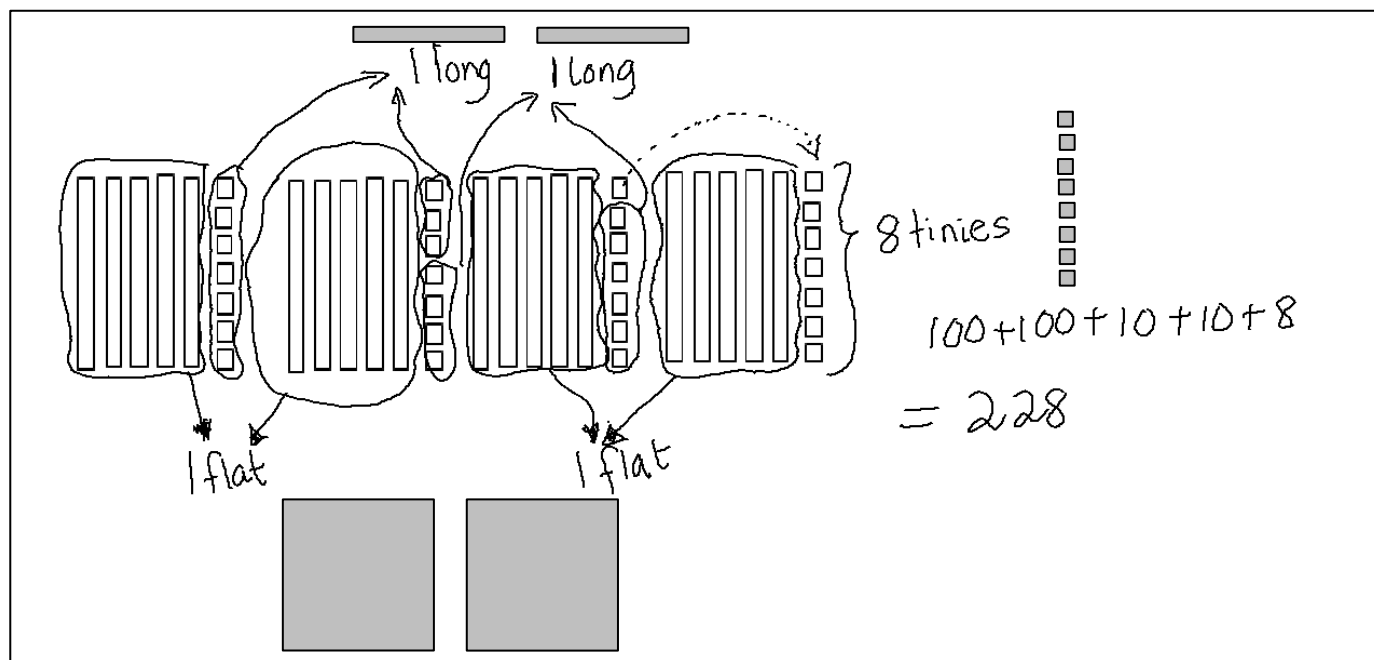
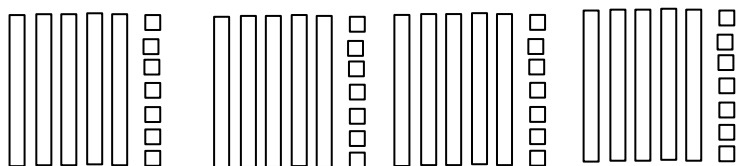
An algorithm is a rule that can be used; a procedure that is carried out which is usually learned by rote, with little understanding. Invented strategies are methods which learners produce themselves. It is usually built on concepts that the learners know already. One often finds that learners invent their own strategies in the way that they understand, and not necessarily the way in which the teacher explains.

- 9 Draw pictures showing how 57×4 could be modelled: with counters, with base – ten blocks, or with areas on base 10 grids. (Use at least two of the methods)

(4)

Base 10 blocks

Set out 5 longs and 7 tinies (4 times)



- 10 What would you do if your learners persist on using repeated subtraction for division problems without really doing any division?

(3)

Let learners use their preferred method of calculation for as long as they are comfortable with it. It is not wrong to use repeated subtraction when large numbers are involved. However, when learners use repeated addition to calculate $100 \div 3$ (for example), then it becomes tedious, and learners could be guided to use subtraction of multiples of 3

$$100 \div 3 \Rightarrow 3 \times 10 = 30 \quad (\text{ten groups of } 3)$$

$$100 - 30 - 30 - 30 = 10 \Rightarrow 10 + 10 + 10 = 30 \quad (\text{Thirty groups of } 3)$$

$$10 - 3 - 3 - 3 = 1 \Rightarrow 1 + 1 + 1 = 3 \quad (\text{Three groups of } 3)$$

$$33 \text{ rem } 1$$

[40]

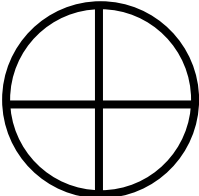
PART C

These questions relate to Chapter 15 – 17 of the prescribed book:

- 1 How can we relate the concept of “sharing” to explain fraction concepts? (2)
- 2 Give examples of each of three categories of fractions: [Illustrate with diagrams]

2.1 Area model

Continuous whole (area model)



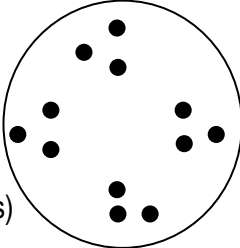
Example" A pizza divided into four equal parts



2.2 Set model

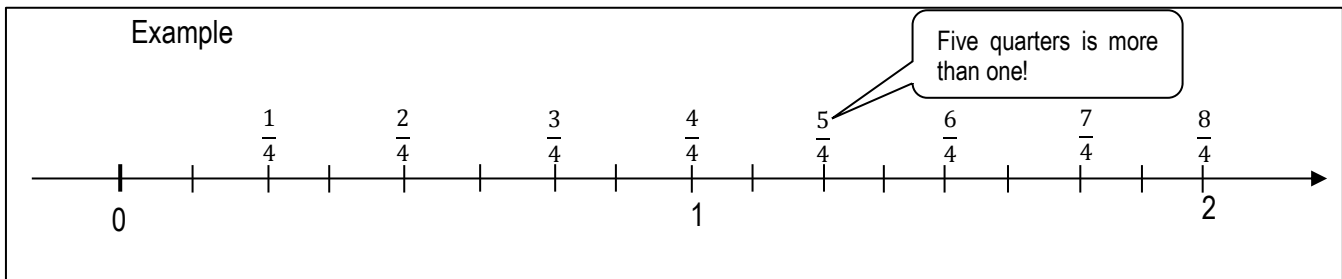
Discrete whole (set model)

- Mary shares 12 sweets between her and 3 friends (4 people)
- Each friend gets one-quarter of the 12 sweets (3 sweets)



Twelve sweets divided by four people – loose objects

2.3 Length model (number line) Paper strips can also be used as length models (6)



- 3 In the context of choosing a “whole”, explain when a “half” is not always equal to a “half”. Give an example. (3)

When thinking of a fraction as a part of a whole, the part will depend on the size of the whole. For example, one half of an orange is not the same as one half of a watermelon. So when we contextualise fractions as a part of “something”, this “something” has to be exactly the same. In the world of numbers, when we talk about a half, we always mean a half of ONE. (one unit)

Some numbers of note:

- A cardinal number tells "how many." Cardinal numbers are also known as "counting numbers," because they show quantity. Cardinal numbers are whole numbers, so fractions are not cardinal numbers.
- Ordinal numbers tell the order of things in a set—first, second, third, etc. Ordinal numbers do not show quantity. They only show rank or position.
- A nominal number names something. Nominal numbers do not show quantity or rank. They are used only to identify something (e.g. a postal code).

4 Use the correct language to explain the difference between the expressions:

"it is the third of March"

This means the third day of the month of March (ordinal number).

"you are third in the row"

This means if there is a row of people, you are the third person from the beginning (ordinal number).

"I want a third of the pizza"

This means if you divide a pizza in three equal parts, each part is one third of the whole (fraction).

(4)

5 The exercise is based on "Pause and Reflect" in your textbook, pp 321 – 322

No "free-hand sketches" will be accepted

Use a ruler and sharp pencil to make accurate drawings

5.1 If the given rectangle represents one whole

- Show one fourth of the whole



- Show two thirds of the whole

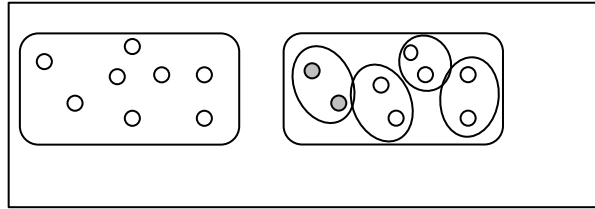


- Show five thirds of the whole



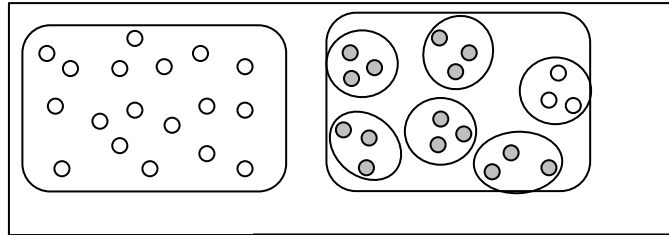
(3)

- 5.2 If eight counters are a whole set, how many are there in one-fourth of the set? Answer: 2



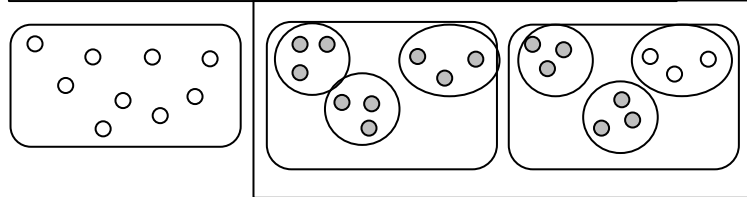
(2)

- 5.3 If 18 counters are a whole set, how many counters would make five-sixths? Answer: 15



(2)

- 5.4 If 9 counters are a whole, how many are in five-thirds of the set? Answer: $9 + \frac{2}{3}$ of 9 = 15

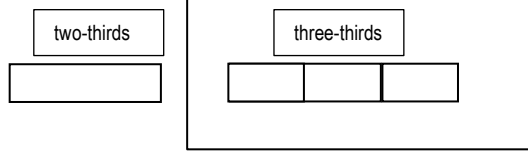


(2)

Use a ruler and sharp pencil to make accurate drawings

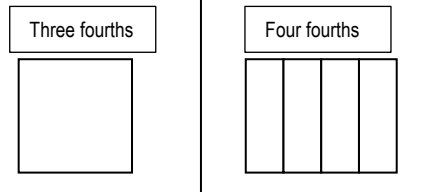
WARNING!!!
No free-hand sketches will be accepted

- 5.5 If this rectangle is two thirds of the whole, what would the whole look like?



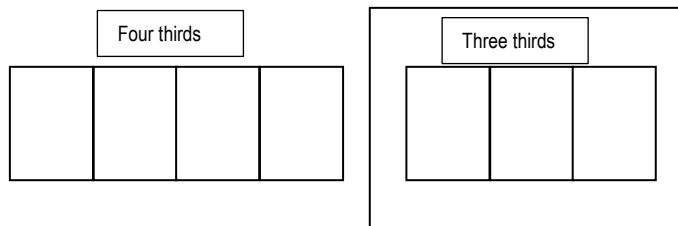
(2)

- 5.6 If this square is three-fourths, draw a shape that could be the whole



(2)

- 6.7 If this rectangle is four – thirds, what would the whole look like?

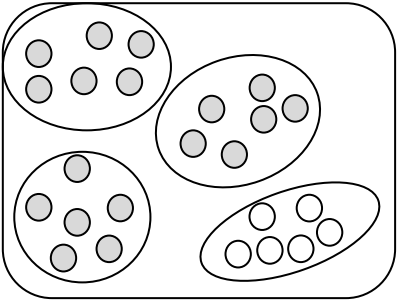
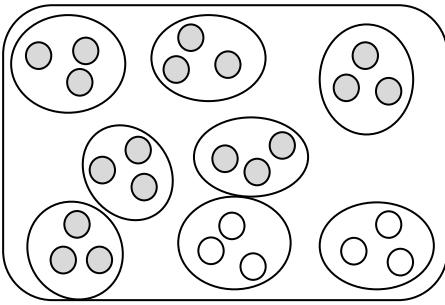


(2)

6 Use the following models to show the equivalence of the fractions $\frac{3}{4}$ and $\frac{6}{8}$

6.1 A set model

Choose the whole to be 24 marbles (loose objects) Can you explain why we choose 24 objects in the whole?

Divide the whole into 4 parts of equal size	Divide the whole into 8 parts of equal size
 The 4 in the $\frac{3}{4}$ tells you into how many parts the whole must be divided	 The 8 in the tells you into how many parts the whole must be divided
The 3 in the $\frac{3}{4}$ tells you how many parts you must choose: Choose 3 parts of 6 marbles each, which is 18 marbles	The 6 in the $\frac{6}{8}$ tells you how many parts you must choose: Choose 6 parts of 3 marbles each, which is 18 marbles

6.2 Area model

Let us choose a rectangle as the whole



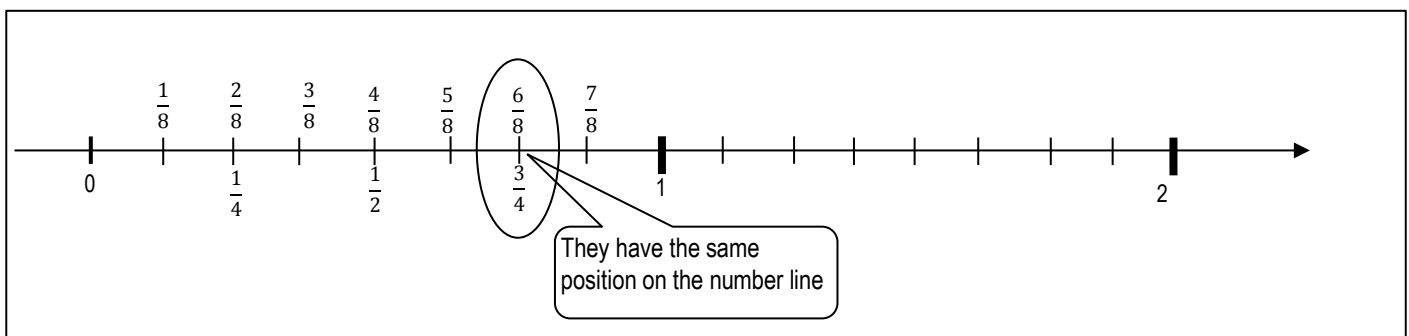
For $\frac{3}{4}$
Divide the whole into 4 equal parts and shade 3



For $\frac{6}{8}$
Divide the whole into 8 equal parts and shade 6

6.3 The number line

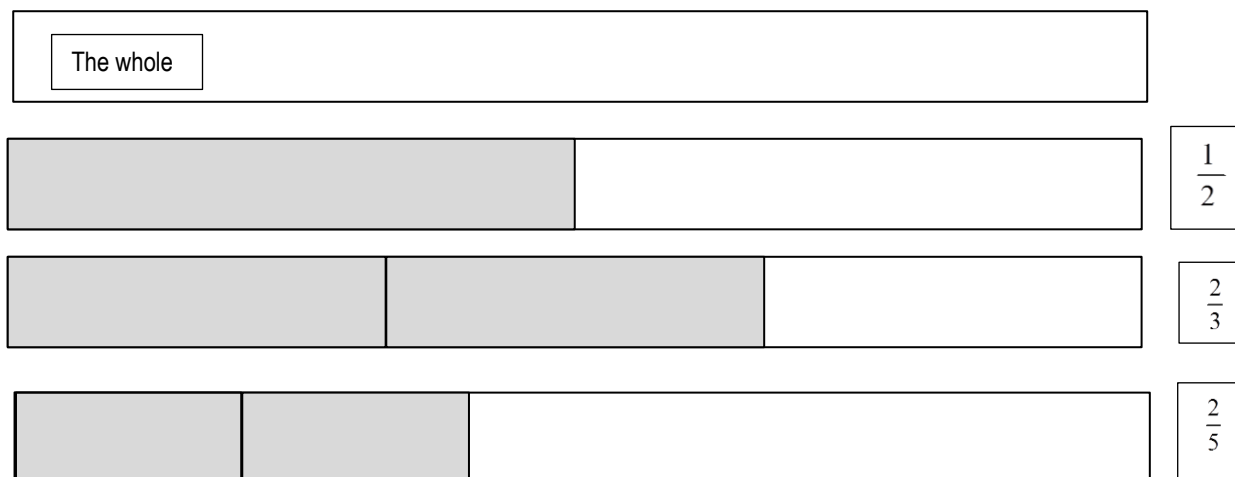
(9)



- 7 Compare the fractions $\frac{1}{2}$, $\frac{2}{3}$ and $\frac{2}{5}$ by making use of the area model. (You should be able to arrange the fractions from small to big). Make sure that you choose the whole correctly, and make accurate drawings. (6)

You will have to choose a whole into which all the denominators can divide, so that you can divide the whole into 2, 3 as well as 5 equal parts.

I am choosing a rectangle with length of 15 cm.



$$\frac{2}{5} < \frac{1}{2} < \frac{2}{3}$$

- 8 Use a standard algorithm to calculate: $1 - \frac{1}{3} - \frac{1}{6}$ (2)

- ① Make the denominators the same. Choose a number that 2 and 6 can divide into (6)
- ② Now write all the fractions with denominators of 6 $1 = \frac{6}{6}$ $\frac{1}{3} = \frac{2}{6}$ $\frac{1}{6} = \frac{1}{6}$
- ③ $1 - \frac{1}{3} - \frac{1}{6}$
 $= \frac{6}{6} - \frac{2}{6} - \frac{1}{6}$
 $= \frac{6-2-1}{6}$ Put over the same denominator
 $= \frac{3}{6}$ or $\frac{1}{2}$

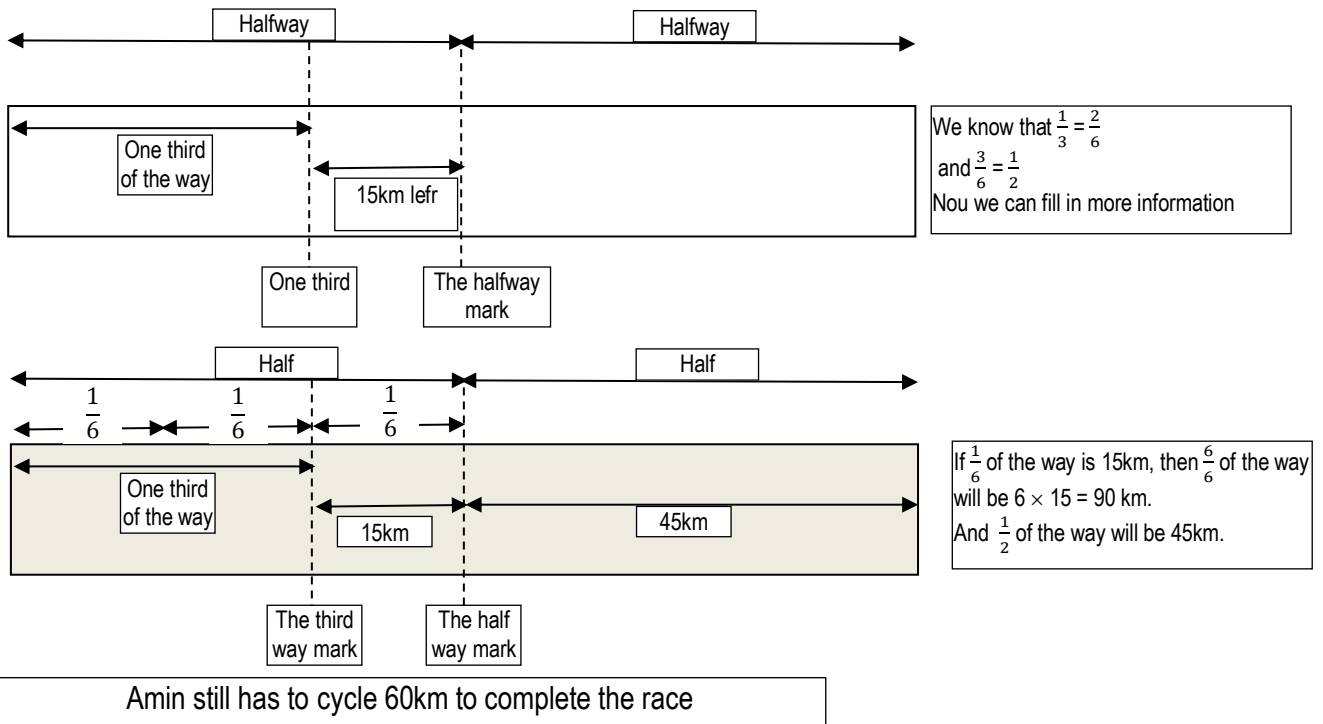
- 9 Mama Matebane bought 5 Bar-Ones for her three children to share fairly between them. What fraction of a whole Bar-One will each child get? Illustrate the solution with drawings. (5)

Each one will get a whole bar one 	Divide two bar ones into three parts each 	Each child will get two-thirds of a whole bar one 
		
		Each child will get one and two-thirds of a whole

- 10 Amin has completed one-third of his cycling race. He is still has 15km to go to reach the halfway mark. How many kilometres he still has to cycle to finish? [Use a diagram to help you] (6)

Let us use a rectangle to model the entire race.

We know that:



11 Use diagrams to illustrate and explain how you will solve the problem:

- 11.1 Sally has a bag of 24 marbles. She gave one – quarter of them away to Sam and one-sixth of them to Parker. What fraction of her marbles does she has left? How many marbles it that? (4)

One-quarter to Sam $\Rightarrow$ 6 marbles

One-sixth to Parker $\Rightarrow$ 4 marbles

He has 14 marbles left, and
 $\frac{14}{24} = \frac{7}{12}$

Using an algorithm to find what fraction he has left:

$$\begin{aligned}
 &1 - \frac{1}{4} - \frac{1}{6} \\
 &= \frac{12 - 3 - 2}{12} \\
 &= \frac{7}{12}
 \end{aligned}$$

- 11.2 Vuyi got a huge pizza to share with her two brothers. Jamie, the youngest got one- sixth of the pizza, and Mpo, the oldest, got one-third. What part of the original pizza is left for herself? (4)

Pizza in thirds

Pizza in sixths

One - third and one-sixth eaten

Half of the pizza remains

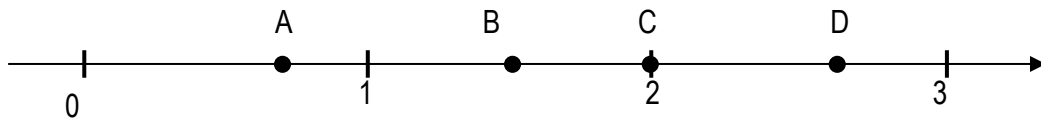
The algorithm:

$$\begin{aligned}
 &1 - \frac{1}{3} - \frac{1}{6} \\
 &= \frac{6 - 2 - 1}{6} \\
 &= \frac{3}{6} = \frac{1}{2}
 \end{aligned}$$

- 12 The following question was given to Grade 6 learners:

Which point on the number line shows $\frac{2}{3}$?

Draw a circle around the correct letter.



Nine percent of the learners chose A as the answer, 14% chose B, 43% chose C and 34% chose D.

- 12.1 What is the correct answer?

(1)

Correct position of $\frac{2}{3}$ is at A (only 9% of learners had it correct)

- 12.2 Give an explanation about the misconceptions learners had when they chose the incorrect answers?

(3)

Possible misconception if learners chose B

Learner could have thought that the 2 indicated the whole, and saw $\frac{2}{3}$ as a part of that length

Possible misconception if learners chose C

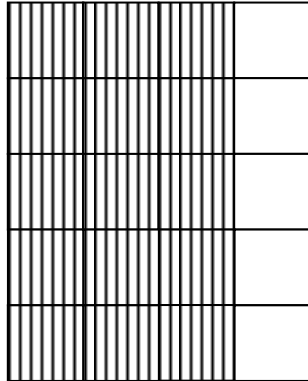
This was the most popular incorrect response. Learners mistakenly took the whole number line (from 1 to 3) as the whole, and then saw $\frac{2}{3}$ as the position of C

Learners who chose D, possibly thought of $\frac{2}{3}$ as a number between 2 and 3.

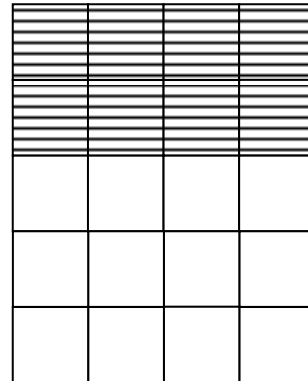
13 Use the grid to illustrate: $\frac{2}{5}$ of $\frac{3}{4}$

(4)

① Shade $\frac{3}{4}$ of the grid like this:



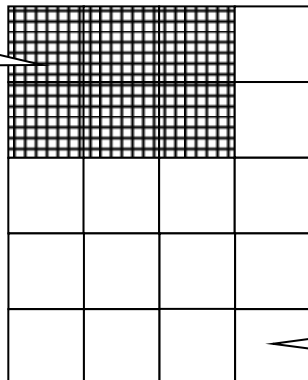
② Shade $\frac{2}{5}$ of the grid like this:



③ The section that overlaps is shaded like this:



$\frac{6}{20}$ of the whole
is double
shaded



This shows $\frac{2}{5}$ of $\frac{3}{4}$ of the whole

Each little
block is $\frac{1}{20}$
of the whole

[74]

PART D

These questions relate to Chapter 20 of the prescribed book:

- 1 Describe in your own words the first three *van Hiele* levels of Geometric thought (level 0, 1 and 2). How do the activities that you will give learners on the three levels differ? (6)

Own words See tut letter 201 page 51

LEVEL 0 Visualization

Learners can classify shapes according to what they look like. They will see a rectangle as the same as a "door". They can distinguish between a rectangle and a square, but only by what the shape looks like and not according to their properties.

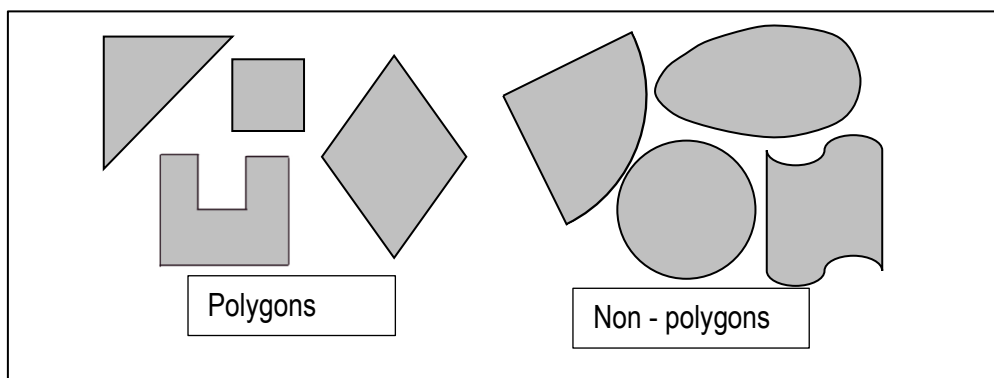
LEVEL 1 Descriptive

Learners can describe shapes according to their properties, for example, a rectangle has equal opposite sides, and all right angles. They can group shapes according to characteristics, but do not yet know how to identify a shape if a set of properties are given. They would usually describe a shape by naming ALL the properties of that shape. For example, they will say a rectangle has equal and parallel opposite sides, equal diagonals, equal angles etc. In other words they do not yet see the minimum requirements for a shape to be identified.

LEVEL 2 Analysis

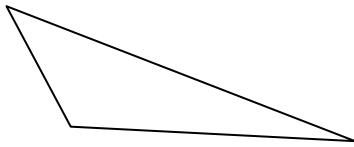
Learners at this level understand the relationships between shapes. They can now identify the minimum requirements for a shape to be identified. So they know that a rectangle is a parallelogram with one right angle, because they understand that all the other properties of a rectangle are included in that definition. They can also identify a square as a kite, because a square has all the properties of a kite.

- 2 Draw an assortment of different types of flat shapes that include polygons and non-polygons (at least three of each kind). Explain your classification. Why is this type of exercise necessary for learners on *van Hiele* level 0? [own explanation] (8)



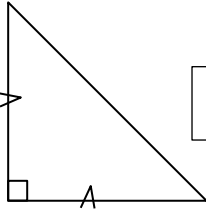
3 Draw the following triangles. Your sketches must be done with a ruler and very neatly drawn.

3.1 Scalene, obtuse angled triangle



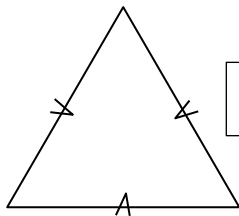
One obtuse angle, no equal sides

3.2 Isosceles, right angled triangle



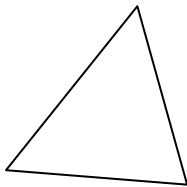
One right angle, two equal sides

3.3 Equilateral triangle



All sides equal

3.4 Acute angled triangle

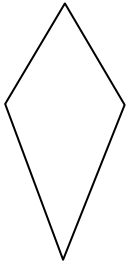


All angles acute

(4)

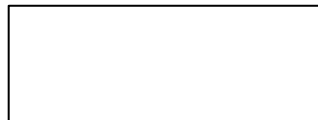
4 Which quadrilaterals are described by the following characteristics? Make a neat drawing of each.

4.1 two pairs of equal adjacent sides



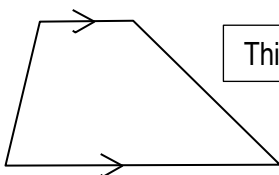
This is a kite

4.2 a parallelogram with a right angle



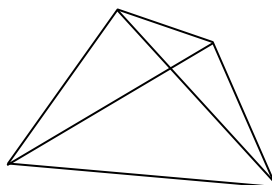
This is a rectangle

4.3 one pair of parallel sides



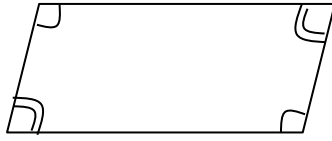
This is a trapezium

4.4 diagonals equal



No particular quadrilateral

4.5 two pairs of opposite angles equal



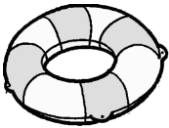
This is a parallelogram

(10)

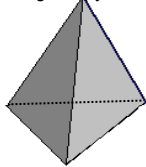
5 Classify the following shapes – polyhedrons or non-polyhedrons. Name each of the objects. (a mathematical name)

NP - non – polyhedron
P - polyhedron

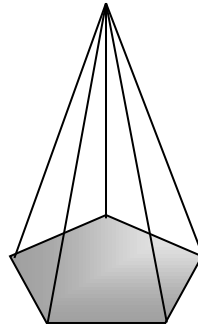
1 NP: Torus



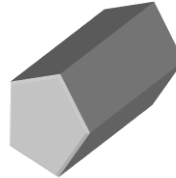
2 P: Tetrahedron
(triangular pyramid)



3 P: Pentagonal pyramid



4 P: Pentagonal prism



5 NP: Cone



6 NP: Cylinder



7 NP: Cylinder



8 NP: Ovoid



9 NP: Ellipsoid



10 P: Cube



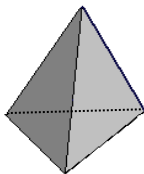
11 NP: Sphere

(11)

6 Draw neat diagrams of the following polyhedra, made up of: (Name the polyhedra)

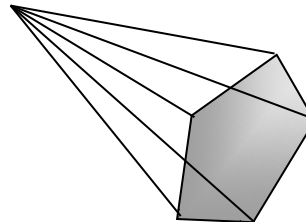
6.1 four triangular faces

Tetrahedron



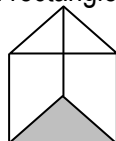
6.2 pentagonal and triangular faces

Pentagonal pyramid



6.3 two triangles and rectangles

Triangular prism

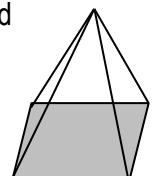


6.4 a pentahedron which is a pyramid

Rectangular/square pyramid

(base must be a quadrilateral)

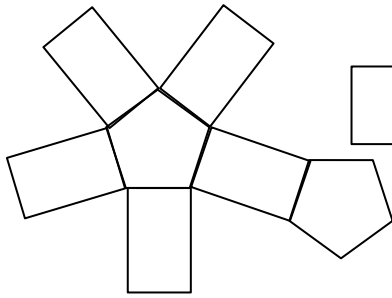
There must be 5 faces.



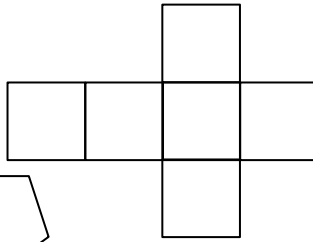
(8)

7 Draw the nets of the following polyhedra:

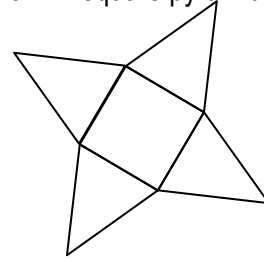
7.1 pentagonal prism



7.2 cube

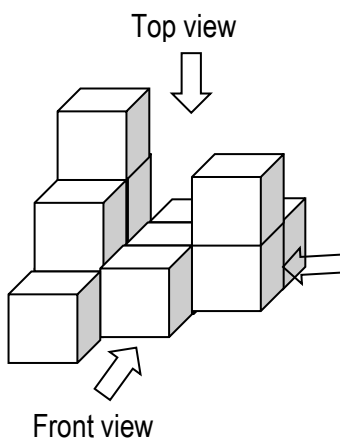


7.3 square pyramid

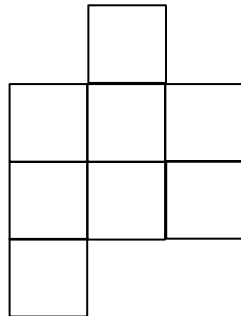


(6)

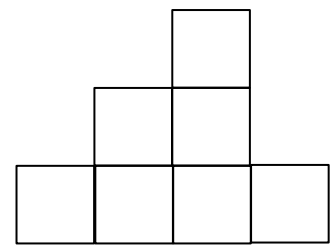
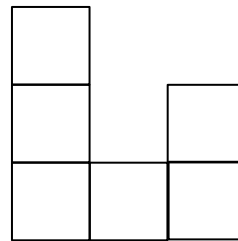
8 Draw the front, top and side view of the following structure



Top view



Front view



Side view

(3)

[56]

The exam paper covers all the work for this module.

You will answer on the exam script.

No calculators are allowed

Students must bring drawing equipment (pencil, ruler, sharpener, eraser, protractor and compass)
--

Drawings may not be done free-hand.

The paper consists of 5 questions, of which question 1 is a multiple choice question.

Questions on the theory, which is integrated in the teaching and learning work

The following guides the student to some issues to be covered in the paper

- Piaget theories
- Rote learning
- Problem solving
- Relational and instrumental understanding
- Doing mathematics
- Cognitive schemes
- Learning theories
- Higher/lower order tasks
- Conceptual and procedural knowledge
- Place value and various models of how to describe place value.
- Models to illustrate concepts. Models to illustrate operations on numbers
- Rules of divisibility
- Prime numbers
- Models to illustrate fraction concepts
- Spatial sense
- Van Hiele and levels of geometrical thinking
- Drawings from different perspectives
- Drawings of and identifying 2D shapes and 3D objects
- Drawings of nets of 3D objects

Best wishes

Dr Ronél Paulsen