

# Mathematics A 2008

Sample assessment instrument and student responses

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Extended modelling and problem solving

December 2009

## Purposes of assessment<sup>1</sup>

The purposes of assessment are to:

- promote, assist and improve student learning
- inform programs of teaching and learning
- provide information for those people — students, parents, teachers — who need to know about the progress and achievements of individual students to help them achieve to the best of their abilities
- provide information for the issuing of certificates of achievement
- provide information to those people who need to know how well groups of students are achieving (school authorities, the State Minister for Education and Training and the Arts, the Federal Minister for Education).

It is common practice to label assessment as being formative, diagnostic or summative, according to the major purpose of the assessment.

The major purpose of formative assessment is to help students attain higher levels of performance. The major purpose of diagnostic assessment is to determine the nature of students' learning, and then provide the appropriate feedback or intervention. The major purpose of summative assessment is to indicate the achievement status or standards achieved by students at a particular point in their schooling. It is geared towards reporting and certification.

## Syllabus requirements

Teachers should ensure that assessment instruments are consistent with the requirements, techniques and conditions of the Mathematics A syllabus and the implementation year 2008.

## Assessment instruments<sup>2</sup>

High-quality assessment instruments<sup>3</sup>:

- have construct validity (the instruments actually assess what they were designed to assess)
- have face validity (they appear to assess what you believe they are intended to assess)
- give students clear and definite instructions
- are written in language suited to the reading capabilities of the students for whom the instruments are intended
- are clearly presented through appropriate choice of layout, cues, visual design, format and choice of words
- are used under clear, definite and specified conditions that are appropriate for all the students whose achievements are being assessed
- have clear criteria for making judgments about achievements (these criteria are shared with students before they are assessed)
- are used under conditions that allow optimal participation for all
- are inclusive of students' diverse backgrounds
- allow students to demonstrate the breadth and depth of their achievements
- only involve the reproduction of gender, socioeconomic, ethnic or other cultural factors if careful consideration has determined that such reproduction is necessary.

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<sup>1</sup> QSA 2008, *P–12 Assessment Policy*, p. 2.

<sup>2</sup> Assessment instruments are the actual tools used by schools and the QSA to gather information about student achievement, for example, recorded observation of a game of volleyball, write-up of a field trip to the local water catchment and storage area, a test of number facts, the Senior External Examination in Chinese, the 2006 QCS Test, the 2008 Year 4 English comparable assessment task.

<sup>3</sup> QSA 2008, *P–12 Assessment Policy*, pp. 2–3.

# Mathematics A 2008

## Sample assessment instrument and student responses

### *Extended modelling and problem solving*

Compiled by the Queensland Studies Authority

December 2009

### ***About this assessment instrument***

The purpose of this document is to inform assessment practices of teachers in schools. For this reason, the assessment instrument is not presented in a way that would allow its immediate application in a school context. In particular, the assessment technique is presented in isolation from other information relevant to the implementation of the assessment. For further information about those aspects of the assessment not explained in this document, please refer to the assessment section of the syllabus.

This instrument provides opportunities for students to:

- recall, select and apply mathematical procedures to situations that are similar to situations already encountered
- apply a sequence of mathematical procedures in situations that are similar to situations already encountered
- interpret, clarify and analyse problems
- use strategies to model and solve problems
- make decisions informed by mathematical reasoning
- organise and present information for different purposes and audiences, in a variety of representations
- develop logical sequences within a response expressed in everyday language, mathematical language, or a combination of both, as required, to justify conclusions, solutions or propositions.

This sample assessment instrument is intended to be a guide to help teachers plan and develop assessment instruments for individual school settings.

## Assessment instrument

The student work presented in this sample is in response to an assessment task which is a type of assessment instrument involving students applying and using relevant knowledge and skills to create a response to a problem or issue.

Appointments at a busy doctor's surgery are made at 10-minute intervals from 9.00 am to 10.50 am, at which time the doctor likes to break for morning tea. Consultations, on average, range from 5 to 15 minutes in duration, depending on the nature of the visit.

The appointments can generally be categorised in the following manner:

Nature of consultation	Average length of consultation
New patient	15 minutes
Test results/follow-up appointment	5 minutes
New illness/complaint	10 minutes
Repeat prescription/injection only	5 minutes

The records show that in one typical week, the following consultations were made.

Nature of consultation	Frequency of consultation
New patient	80
Test results/follow-up appointment	40
New illness/complaint	80
Repeat prescription/injection only	40

Before a new patient can see the doctor, the medical receptionist and patient must complete the following tasks.

<b>Activity</b>	<b>Approximate Time</b>
Type and print out name label for file folder	60 seconds
Stick label to folder and enter doctor's record sheet	10 seconds
Confirm payment method and take payment details	10 seconds
Mark off in appointment book and computer	40 seconds
Patient to fill in personal details form	2 minutes
Details entered into computer by receptionist	3 minutes
Receptionist to take and record patient's height, weight and blood pressure	5 minutes

In order to avoid idle time at the start of the day, 2 patients are always booked in at 9.00 am. Every other appointment time is filled with only 1 appointment.

### **Assumptions**

- Patients arrive exactly on time (i.e. at the time of their appointment).
- If the doctor is free, they will see a patient as soon as the patient arrives.
- The doctor completes all appointments.
- New patients arrive early enough so that they are not late for their appointment

**Question 1**

Draw an activity table and a project network to determine how long new patients should arrive before their scheduled appointment so that there is no delay.

**Question 2**

- a) Determine the probability of each type of consultation.
- b) Use this information to simulate the type of appointment using an appropriate method of generating random numbers and put the information into a table. Simulations must be completed for all patients up to and including the 10.50 am appointment.

The following example may be helpful

Appointment Time	Random Number	Reason for appointment	Time for consultation
9.00 am			
9.10 am			
9.20 am			
9.30 am			

**Question 3**

Draw a time plot to illustrate your simulation

**Question 4**

What is the average patient waiting time?

**Question 5**

What is the doctor's total idle time?

**Question 6**

At what time will the doctor be able break for morning tea or lunch?

## Instrument-specific criteria and standards

Schools draw instrument-specific criteria and standards from the syllabus dimensions and exit standards. Schools will make judgments about the match of qualities of student responses with the standards descriptors that are specific to the particular assessment instrument. While all syllabus exit descriptors might not be assessed in a single assessment instrument, across the course of study, opportunities to demonstrate all the syllabus dimensions and standards descriptors must be provided.

The assessment instrument presented in this document provides opportunities for the demonstration of the following criteria:

- Knowledge and procedures
- Modelling and problem solving
- Communication and justification.

This document provides information about how the qualities of student work match the relevant instrument-specific criteria and standards at standards A and C. The standard A and C descriptors are presented below. The complete set of instrument-specific criteria and standards is on page 22.

	Standard A	Standard C
Knowledge and	<p>The student's work has the following characteristics:</p> <ul style="list-style-type: none"> <li>• application of <u>simple through to complex sequences</u> of mathematical procedures in <u>routine and non-routine situations</u></li> </ul>	<p>The student's work has the following characteristics:</p> <ul style="list-style-type: none"> <li>• application of <u>simple sequences</u> of mathematical procedures in <u>routine situations</u></li> </ul>
Modelling and problem solving	<p>The student's work has the following characteristics:</p> <ul style="list-style-type: none"> <li>• use of strategies to model and solve problems in <u>complex routine through to simple non-routine</u> situations</li> <li>• informed decisions based on mathematical reasoning in <u>complex routine through to simple non-routine</u> situations</li> </ul>	<p>The student's work has the following characteristics:</p> <ul style="list-style-type: none"> <li>• use of <u>familiar strategies</u> for problem solving in <u>simple routine</u> situations</li> <li>• informed decisions based on mathematical reasoning in <u>simple routine</u> situations</li> </ul>
Communication and justification	<p>The student's work has the following characteristics:</p> <ul style="list-style-type: none"> <li>• organisation and presentation of information in a variety of representations in <u>simple non-routine through to complex routine</u> situations</li> <li>• <u>analysis and translation</u> of information displayed from one representation to another in <u>complex routine</u> situations</li> </ul>	<p>The student's work has the following characteristics:</p> <ul style="list-style-type: none"> <li>• organisation and presentation of information in a variety of representations in <u>simple routine</u> situations</li> <li>• <u>translation</u> of information displayed from one representation to another in <u>simple routine</u> situations</li> </ul>

Key: Differences or additional requirements for demonstrating the standard.  
Differences in complexity of task requirements for each standard

# Sample student response: Standard A

## Standard descriptors Student response A

Maths A, term 3

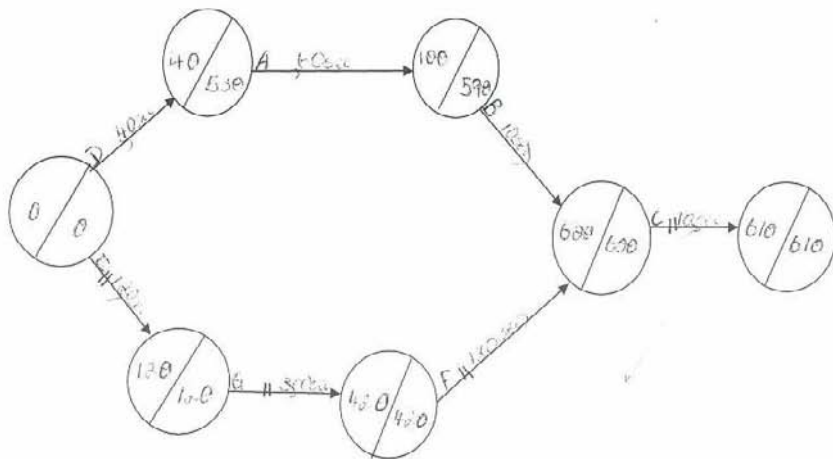
In today's society doctor surgeries are very busy. Appointments are made at 10 minute intervals from 9:00am till 10:50am. At this time they have a break for morning tea. On average consultations range from 5-15 minutes, the time depends on the nature of the visit. A new patient takes on average 15 minutes, test results, follow up appointments, repeat prescriptions and injections take 5 minutes whereas a new illness takes around 10 minutes.

**Task one:**

An activity table and a project network must be drawn to determine how long a new patient should arrive before their scheduled appointment so there is less delay.

	Activity	Approximate Time	Prerequisite
A	Type and print out name label for file folder	60 seconds	D ✓
B	Stick label to folder and enter doctor's record sheet	10 seconds	A ✓
C	Confirm payment method and take payment details	10 seconds	A-B, D-G ✓
D	Mark off in appointment book and computer	40 seconds	None ✓
E	Patient to fill in personal details form	120 seconds	none ✓
F	Details entered into computer by receptionist	180 seconds	G ✓
G	Receptionist to take and record patients height, weight and blood pressure	300 seconds	E ✓

Application of mathematical procedures in a routine situation



The Critical activities are E, G, F, C

The procedure should take 610 seconds which is 10 minutes and 10 seconds. The surgery should ask the new patients to arrive 11 minutes early; this is so they are ready for the appointment even if there are a couple of delays.



# Sample student response: Standard A

Use of strategies to model a problem in a simple non-routine situation

Organisation and presentation of information in a simple non-routine situation

## Task two:

How I must find the probability of each consultation occurring, to do this I divided the frequency by the total frequency. Following this I allocated a random number (a die was used for this), to simulate the type of nature of the consultation.

Nature of Consultation	Frequency of consultation	probability	Random Number
New patient	80	1/3	1,2
Test results/follow up appointment	40	1/6	3
New illness/ complaint	80	1/3	4,5
Repeat prescription/injection only	40	1/6	6

Below is the appointment book for Doctor Kuffsi's surgery, A die was rolled to find out what type of appointment was needed.

Appointment time	Random number	Reason for appointment	Time for consultation
9:00 am	1	New patient	15 minutes
9:00 am	6	Repeat prescription/ injection only	5 minutes
9:10 am	1	New patient	15 minutes
9:20 am	5	New illness/ complaint	10 minutes
9:30 am	2	New patient	15 minutes
9:40 am	1	New patient	15 minutes
9:50 am	6	Repeat prescription/ injection only	5 minutes
10:00 am	6	Repeat prescription/ injection only	5 minutes
10:10 am	1	New patient	15 minutes
10:20 am	3	Test results/ follow up appointment	5 minutes
10:30 am	5	New illness/ complaint	10 minutes
10:40 am	4	New illness/ complaint	10 minutes
10:50 am	2	New patient	15 minutes

6 patients were new to the clinic, 1 patient test results or a follow up appointment, 3 patients had new illnesses or a complaint and 3 patients had a repeat prescription or an injection

## Task three:

Task 3 is a time plot which illustrates the progression of the appointments. A time plot shows each consultation, idle time and patient waiting time. The time plot is attached at the back.

## Task four:

This information is gathered from the task 3 time plot.

Total waiting time is  $0+15+10+15+15+20+25+20+15+20+15+15+15= 200$  minutes

Average waiting time is  $200/13= 15.38$  which makes the average waiting time 16 minutes.

## Task five:

By looking at the time plot you can see that Doctor Kuffsi had no idle time. This is good for the association the hired him.

## Task six:

Doctor Kuffsi can go on his lunch break at 11:20am; this is half an hour (30 minutes) after the preferred time. This could be avoided or shortened by making the appointment booking times longer. The appointments could be booked in 15 minute intervals.

# Sample student response: Standard A

Use of strategies to model a problem in a simple non-routine situation

## Task seven:

To generate the random numbers, I used the random number function on my calculator. The random numbers are three digits and each time I took the last digit, the last digit was selected because it had to be taken from the same place each time and it was easier and faster for me to see that number.

The numbers below are used to determine whether a patient is on time, early or late. 70% of patients are on time, 20% are early and only 10% are late.

$70\% = 7/10$ , this means 7 out of 10 digits represent that a patient is on time, the same equation was completed for early and late patient.

Random numbers for on time	Random numbers for early	Random numbers for late
1	8	0
2	9	
3		
4		
5		
6		
7		

Following is an appointment book that shows new appointments and whether the patient is early or late. The numbers in the above table were used in the below table.

Appointment time	Nature of appointment			On time/ Late/ early		
	Random number	Reason for appointment	Time taken	Random number	On time /late/ early	Arrival time
9:00 am	3	Test result/follow up appointment	5min	3	On time	9:00am
9:00 am	5	New illness/complaint	10min	5	On time	9:00am
9:10 am	4	New illness/complaint	10min	2	On time	9:10am
9:20 am	6	Repeat prescription/ Injection only	5min	8	Early	9:15am
9:30 am	4	New illness/complaint	10min	3	On time	9:30am
9:40 am	2	New patient	15min	1	On time	9:40am
9:50 am	1	New patient	15min	3	On	9:50am

Organisation and presentation of information in a simple non-routine situation

10:00 am	5	New illness/complaint	10min	1	On time	10:00am
10:10 am	3	Test result/follow up appointment	5min	8	Early	10:05am
10:20 am	6	Repeat prescription/ Injection only	5min	6	On time	10:20am
10:30 am	6	Repeat prescription/ Injection only	15min	2	On time	10:30am
10:40 am	2	New patient	15min	6	On time	10:40am
10:50 am	3	Test result/follow up appointment	15min	4	On time	10:50am

There is a time plot attached at the back which shows these appointments.

With patients arriving early to their appointment, the doctor could see most off them before their actual appointment time. This made a 15 minute difference to task three. Doctor Kuffsi can now go on his break at 11:05am.

The average waiting time is  $0+5+5+10+0+0+5+10+15+5+0+5+10 = 70/13 = 5.38$  minutes which averages out to 6 minutes. The maximum queuing amount was two patients; however the maximum queuing amount could change if there were three or more 15 minute appointment in a row.

# Sample student response: Standard A

Organisation and presentation of information in a simple non-routine situation

**Task eight:**

Doctor Kuffsi was given the opportunity to either hire another doctor or make his appointments in 15 minute intervals not 10 minutes appointments. Below are two tables that show a 15 minute booking time and an appointment booking with two doctors at 10 minute booking lots. There is also a time plot attached at the back for both of the tables.

A) 15 minute appointment times:

Appointment Time	Random number	Reason for appointment	Time taken	Random number	On time/late/early	Arrival time
9:00am	2	New patient	15 min	5	On time	9:00am
9:00am	5	New illness/ complaint	10 min	3	On time	9:00am
9:15am	1	New patient	15 min	3	On time	9:15am

9:30am	4	New illness/ complaint	10 min	6	On time	9:30am
9:45am	3	Test result/follow up appointment	5 min	9	Early	9:40am
10:00am	3	Test result/follow up appointment	5 min	7	On time	10:00am
10:15am	5	New illness/ complaint	10 min	9	Early	10:10am
10:30am	6	Repeat prescription/ injection only	5 min	6	On time	10:30am
10:45am	6	Repeat prescription/ injection only	5 min	4	On time	10:45am

B) two doctors working in 10 minutes appointment times:

Appointment time	Random number	Reason for appointment	Time taken	Random number	On time/early/late	Arrival time
9:00am	5	New illness/ complaint	10 min	3	On time	9:00am
9:00am	3	Test results/follow up appointment	5 min	7	On time	9:00am
9:00am	1	New patient	15 min	1	On time	9:00am
9:00am	6	Repeat prescription/ injection only	5 min	1	On time	9:00am
9:10 am	4	New illness/ complaint	10 min	4	On time	9:10am
9:10am	5	New illness/ complaint	10 min	7	On time	9:10am
9:20am	3	Test results/follow up appointment	5 min	1	On time	9:20am
9:20am	2	New patient	15 min	9	Early	9:15am
9:30am	6	Repeat prescription/ injection only	5 min	4	On time	9:30am
9:30am	3	Test results/follow	5 min	9	Early	9:25am

# Sample student response: Standard A

		up appointment				
9:40am	3	Test results/follow up appointment	5 min	2	On time	9:40am
9:40am	6	Repeat prescription/injection only	5 min	8	Early	9:35am
9:50am	4	New illness/complaint	10 min	5	On time	9:50am
9:50am	4	New illness/complaint	10 min	9	Early	9:45am
10:00am	3	Test results/follow up appointment	5 min	3	On time	10:00am
10:00am	3	Test results/follow up appointment	5 min	7	On time	10:00am
10:10am	1	New patient	15 min	3	On time	10:10am
10:10am	5	New illness/complaint	10 min	2	On time	10:10am
10:20am	3	Test results/follow up appointment	5 min	5	On time	10:20am
10:20am	2	New patient	15 min	1	On time	10:20am
10:30am	3	Test results/follow up appointment	5 min	8	Early	10:25am
10:30am	4	New illness/complaint	10 min	4	On time	10:30am
10:40am	5	New illness/complaint	10 min	9	Early	10:35am
10:40am	1	New patient	15 min	2	On time	10:40am
10:50am	2	Test results	5 min	5	On time	10:50am
10:50am	3	Test results/follow up appointment	5 min	3	On time	10:50am

When looking at both time plots for task 8, it is clearly seen that it would be more beneficial for Doctor Kuffsi to hire another Doctor. When Doctor Kuffsi made his appointments 15

minute block, he went to lunch on time, however he loses half of his appointments and potentially half his money. By hiring another doctor to work at the surgery Doctor Kuffsi will gain twice the amount of patients and Doctor Kuffsi will make more money. He will receive more money by hiring another doctor than he will lose from paying him/her.

Informed decisions based on mathematical reasoning in a simple non-routine situation

The surgery with 15 minute booking times:

Idle time =  $5+5+10+10=30$  minutes

Total waiting time =  $0+15+10+10=10+0+0=0+0=45$  minutes

Average waiting time =  $45/9=5$  minutes

Time worked in lunch time = 0 minutes

The surgery when there were two doctors working with 10 minute booking times:

Idle time for both doctors  $5+5=15$  minutes

Total waiting time =  $0+0+10+5+15+0+15+5+10+10+5+5+0+0+0+0+0+5+0+5+5+0+5+0+10=110$  minutes

Average waiting time =  $110/26=4.23$  minutes which averages out to 5 minutes.

Overall I would recommend that Doctor Kuffsi hires another doctor, although they will not go out onto lunch on time, every other aspect of having two doctors would benefit the surgery, whether there is one to two doctors the average waiting time for a patient is 5 minutes and with two doctors the idle time decreased by 15 minutes.

## Sample student response: Standard A

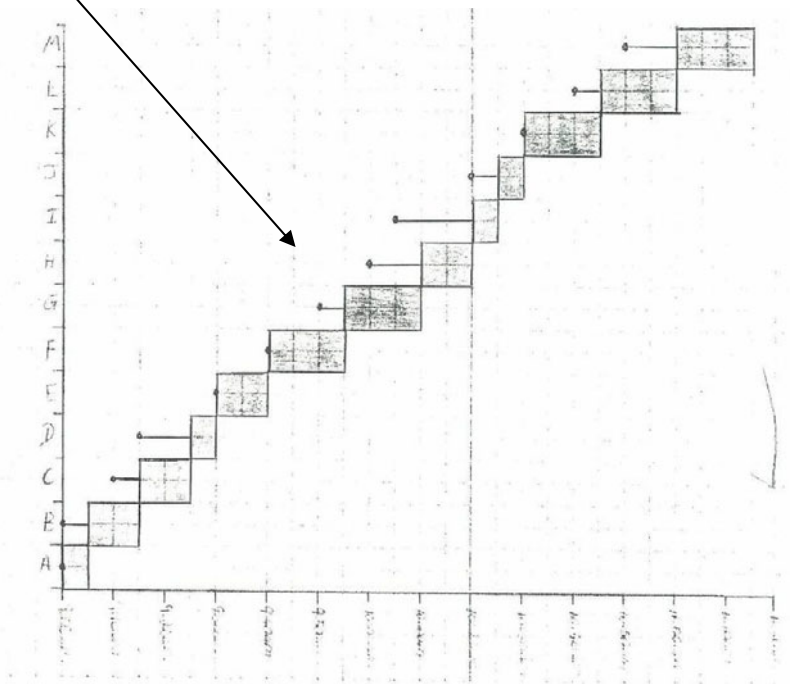
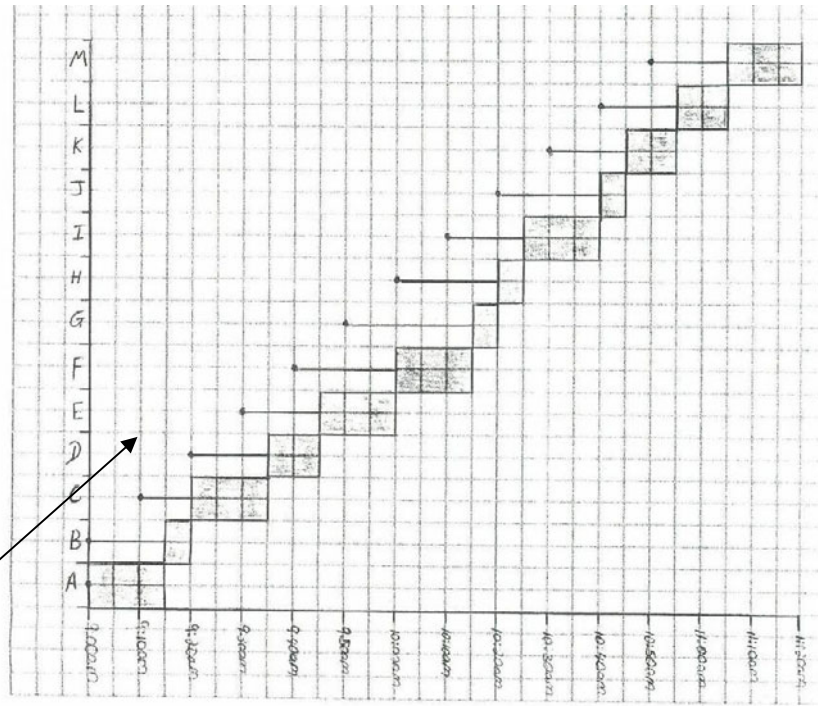
To sum up this task:

	15 minute appointments	Two doctors
<b>Advantages</b>		
Surgery	There were no significant advantages for the surgery.	They are gaining more patients and therefore making more money.
First doctor	Went out to his lunch break on time.	He will not have as much stress on himself to serve all the patients.
Patient	Waiting time is an average of 5 minutes.	Waiting time is an average of 5 minutes
<b>Disadvantages</b>		
Surgery	They are losing patients because there is less appointments, and the doctor has half an hour idle	They have to pay the second doctor his wages.

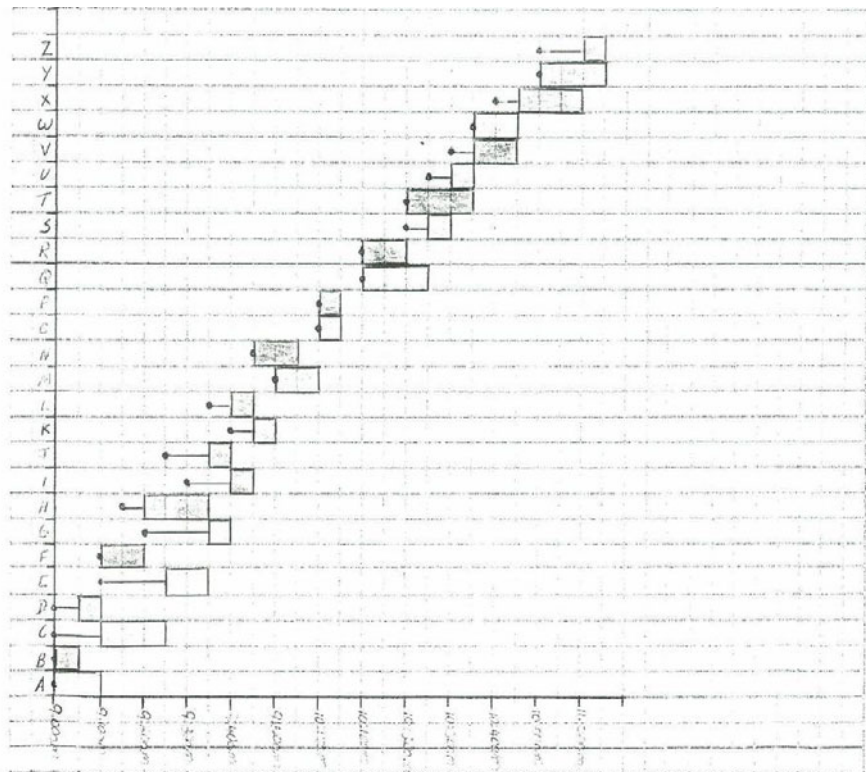
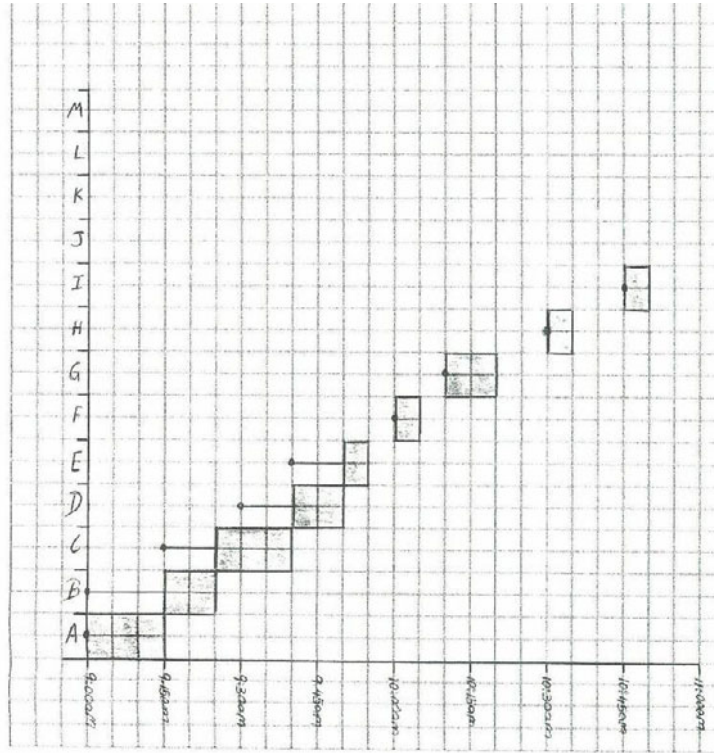
First doctor	time. he has half and hour idle time	May lose some of his closest patients.
Patient	there were no significant disadvantages for the patient	May have to start seeing a new doctor.

# Sample student response: Standard A

Analysis and translation of information displayed from one representation to another in complex routine situations



# Sample student response: Standard A



# Standard C

## Standard descriptors

## Student response C

Application of simple sequences of mathematical procedure in routine situations

Appointments at a busy doctor's surgery are made at 10-minute intervals from 9.00am to 10.50am. At which time, she likes to break for morning tea. Consultations, on average, range from 5 – 15 minutes in duration depending on the nature of the visit.

The appointments can generally be categorised in the following manner.

Nature of consultation	Average length of consultation
New patient	15 minutes
Test results/ follow up appointment	5 minutes
New illness/ complaint	10 minutes
Repeat prescription/injection only	5 minutes

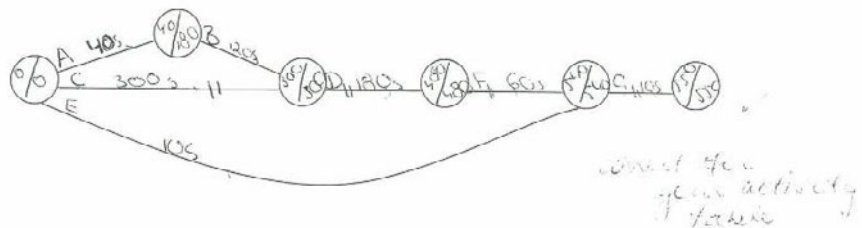
The records show that in one typical week, the following consultations have been made.

Nature of consultation	Frequency of consultation
New patient	80
Test results/ follow up appointment	40
New illness/ complaint	80
Repeat prescription/injection only	40

Before new patients can see the doctor, the medical receptionist and patient must complete the following tasks.

### TASK 1

Activity	Time	Prerequisites
A Mark off in appointment	40 seconds	None
B Patient fill in personal detail form	2 minutes	A
C Record height and weight	5 minutes	none
D Details entered into computer	3 minutes	B, C
E Confirm payment	10 seconds	NONE
F Type and print name label	60 seconds	D
G Stick label to folder	10 seconds	F, E





# Standard C

Use of familiar strategies for problem solving in simple routine situations

## TASK TWO a)

Nature of consultation	Frequency	Probability	Random Number
New Patient	80	$80/240 = 1/3$	3,4
Test Result	40	$40/240 = 1/6$	1
New Illness	80	$80/240 = 1/3$	2,5
Repeat Prescription	40	$40/240 = 1/3$	6

In order to avoid idle time at the start of the day, 2 patients are always booked in at 9.00am. Very other appointment time is filled with only 1 appointment.

## ASSUMPTIONS

- Patients arrive exactly on time (i.e. at the time of their appointment)
- In the doctor is free, they will see a patient as soon as they arrive.
- The doctor completes all appointments
- New patients arrive early enough so that they are not late for their appointment.

## TASK TWO b)

*Explain how you simulated the appointment types*

	Appointment Time	Random Number	Nature of Consultation	Time
A	9.00	6	Repeat Prescription	5
B	9.00	2	New Illness	10
C	9.10	5	New Illness	10
D	9.20	4	New Patient	15
E	9.30	3	New Patient	15
F	9.40	3	New Patient	15
G	9.50	1	Test result	5
H	10.00	1	Test Result	5
I	10.10	5	New Illness	10
J	10.20	5	New Illness	10
K	10.30	5	New Illness	10
L	10.40	4	New Patient	15
M	10.50	2	New Illness	10

## TASK FOUR

For each new patient that enters the doctors surgery it was found that on average each patient would be waiting approximately 6 minutes before seeing the doctor.

Waiting time divided by amount of patients  
 $75 \div 13 = 5.77$  approx 6 minutes waiting time

## TASK FIVE

Due to each patient arriving on time, there was no apparent idle time.

## TASK SIX

At 11.10 am the doctor can have morning tea.

## TASK SEVEN

Arrival Time	Frequency	Probability	Random Number
On time	70	$70/100 = 7/10$	0,1,2,3,4,5,6
Early	20	$20/100 = 2/10$	7,8
Late	10	$10/100 = 1/10$	9

Organisation and presentation of information in a variety of representations in simple non-routine situations

App time	Random number	Reason	Time	Random number	On time/early/late	Arrival time
9.00	6	Prescription	5	9	Late	9.05
9.00	2	Illness	10	5	On time	9.00
9.10	5	Illness	10	3	On time	9.10
9.20	4	patient	15	7	Early	9.15
9.30	3	Patient	15	6	On time	9.30
9.40	3	Patient	15	9	Late	9.45
9.50	1	Result	5	7	Early	9.45
10.00	1	Result	5	8	Early	9.55
10.10	5	Illness	10	5	On time	10.10
10.20	5	Illness	10	8	Early	10.15
10.30	5	Illness	10	0	On time	10.30
10.40	4	Patient	15	7	Early	10.35
10.50	2	Illness	10	1	On time	10.50

# Standard C

When determining the arrival time of the patient being either on time, early or late, it does not affect the amount of time spent on each patient rather it affects the amount of time each patient may have to wait to have an appointment.

## TASK EIGHT

Two practitioners working in the surgery

Appointment time	Random number	Nature of Consultation	Time	Random Number	On time/ Early/ late	Arrival Time
9.00	1	Test Result	5	1	On time	9.00
9.00	5	New Illness	10	3	On time	9.00
9.00	6	Repeat Prescription	5	2	On time	9.00
9.00	1	Test Result	5	4	On time	9.00
9.10	2	New Illness	10	9	Late	9.05
9.10	1	Test Result	5	4	On time	9.10
9.20	5	New Illness	10	9	Late	9.25
9.20	3	New Patient	15	8	Early	9.15
9.30	4	New Patient	15	0	On time	9.30
9.30	3	New Patient	15	8	Early	9.25
9.40	1	Test Result	5	2	On time	9.40
9.40	6	Repeat Prescription	5	4	On time	9.40
9.50	5	New Illness	10	5	On time	9.50
9.50	1	Test Result	5	8	Early	9.45
10.00	6	Repeat Prescription	5	3	On time	10.00
10.00	4	New Patient	15	5	On time	10.00

10.10	6	Repeat Prescription	5	1	On time	10.10
10.10	1	Test Result	5	7	Early	10.05
10.20	4	New Patient	15	2	On time	10.20
10.20	4	New Patient	15	5	On time	10.20
10.30	4	New Patient	15	4	On time	10.30
10.30	3	New Patient	15	7	Early	10.25
10.40	1	Test Result	5	5	On time	10.40
10.40	6	Repeat Prescription	5	3	On time	10.40
10.50	2	New Illness	10	5	On time	10.50
10.50	5	New Illness	10	3	On time	10.50

### 15 minute intervals

Appointment time	Random number	Nature of Consultation	Time	Random number	On time/ Early/Late	Arrival Time
9.00	4	New Patient	15	4	On time	9.00
9.00	1	Test Result	5	5	On time	9.00
9.15	2	New Illness	10	8	Early	9.10
9.30	6	Repeat Prescription	5	9	Late	9.35
9.45	5	New Illness	10	0	On time	9.45
10.00	3	New Patient	15	3	On time	10.00
10.15	1	Test Result	5	9	Late	10.20
10.30	6	Repeat Prescription	5	8	Early	10.25
10.45	2	New Illness	10	1	On time	10.45

### Two practitioners and 15 minute intervals

Appointment time	Random Number	Nature of Consultation	Time	Random Number	On time/ Early/Late	Arrival Time
9.00	3	New Patient	15	1	On time	9.00
9.00	5	New Illness	10	8	Early	8.55
9.00	1	Test Results	5	0	On time	9.00
9.00	3	New Patient	15	6	On time	9.00
9.15	6	Repeat Prescription	5	4	On time	9.15
9.15	1	Test Results	5	8	Early	9.10
9.30	4	New Patient	15	3	On time	9.30
9.30	5	New Illness	10	6	On time	9.30
9.45	2	New Illness	10	9	Late	9.50
9.45	6	Repeat Prescription	5	4	On time	9.45
10.00	3	New Patient	15	7	Early	9.55
10.00	2	New Illness	10	5	On time	10.00
10.15	2	New Illness	10	2	On time	10.15
10.15	4	New Patient	15	5	On time	10.15
10.30	5	New Illness	10	6	On time	10.30
10.30	3	New Patient	15	9	Late	10.25
10.45	5	New Illness	10	8	Early	10.40
10.45	5	New Illness	10	4	On time	10.45

# Standard C

Two doctors

	ADVANTAGES	DISADVANTAGES
The surgery	<ul style="list-style-type: none"> <li>• More patients being served ✓</li> <li>• Higher income ✓</li> </ul>	<i>two doctors paid increased expenses.</i>
The first doctor	<ul style="list-style-type: none"> <li>• Break on time ✓</li> </ul>	
The patients	<ul style="list-style-type: none"> <li>• Less waiting time ✓</li> </ul>	<i>patient may be waiting even if not sick.</i>

15 minute intervals

	ADVANTAGES	DISADVANTAGES
The surgery	<i>well used time looks good for surgery</i>	<ul style="list-style-type: none"> <li>• Less patients being served ✓</li> <li>• Lower income ✓</li> </ul>
The first doctor	<ul style="list-style-type: none"> <li>• Break on time ✓</li> </ul>	<ul style="list-style-type: none"> <li>• Idle time ✓ <i>harder to balance</i></li> </ul>
The patients	<ul style="list-style-type: none"> <li>• Nearly no waiting time ✓</li> </ul>	<i>harder to balance</i>

Two doctors and 15 minute intervals

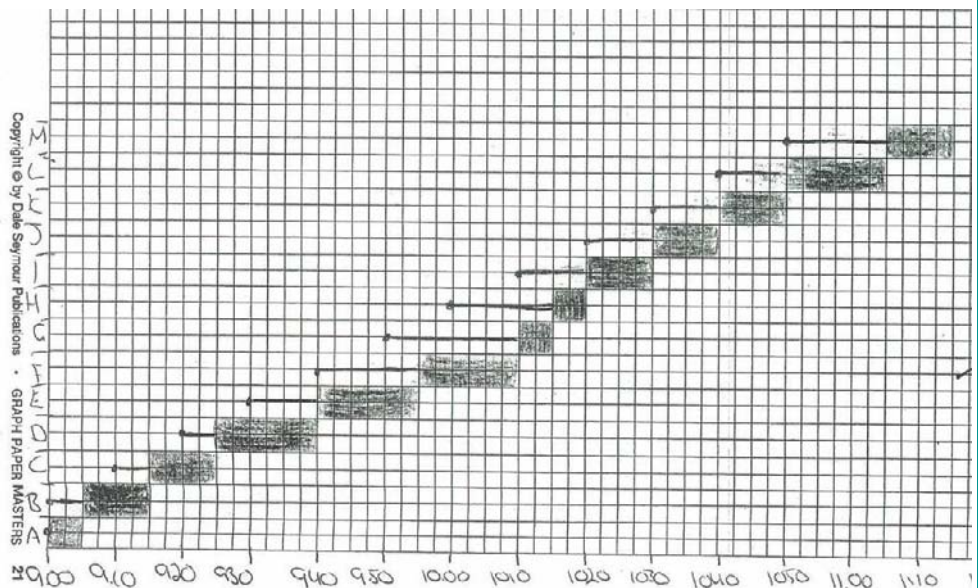
	ADVANTAGES	DISADVANTAGES
The surgery	<ul style="list-style-type: none"> <li>• Decent amount of patients being served ✓</li> <li>• Higher income ✓</li> </ul>	<i>fewer patients</i>
The first doctor	<ul style="list-style-type: none"> <li>• Break on time ✓</li> </ul>	<ul style="list-style-type: none"> <li>• Slight amount of idle time ✓</li> </ul>
The patients	<ul style="list-style-type: none"> <li>• Less waiting time ✓</li> </ul>	•

Informed decisions based on mathematical reasoning in routine situations

In a doctor's surgery where there are two doctors working it was found that there was more patients being served in a shorter amount of time with less waiting time and no idle time. When the appointments were divided into 15 minute intervals it became apparent that there was a lot of idle time and less patients being served and when combining the 2 doctors and 15 minute intervals, there was a slight amount of idle time but less amount of patients being served. When comparing these three different structures for the surgery to work in it was apparent that having two doctors working in the surgery and the original time span of 10 minutes had more efficiency when looking at the amount of idle time, amount of patients being served and the waiting time for each patient.

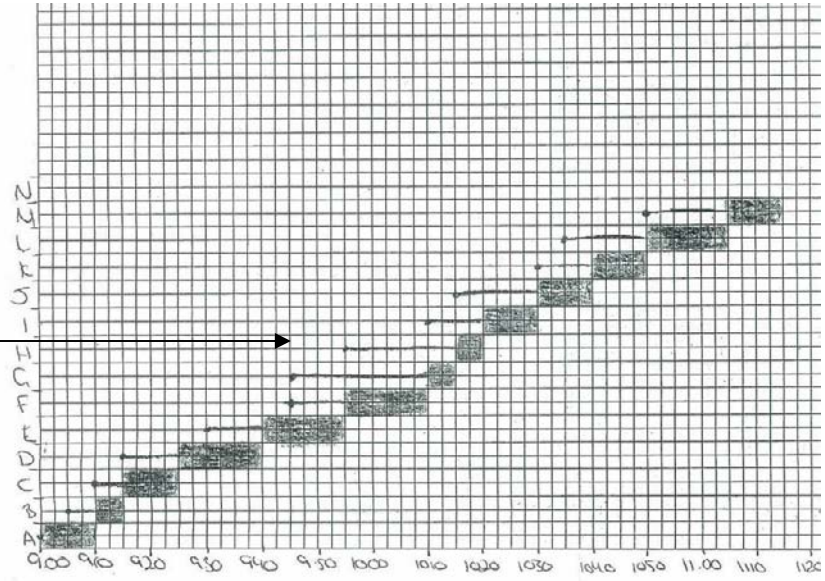
I recommend that this particular doctor's surgery uses the new technique of having two doctors working in the doctor's surgery.

## Task 3



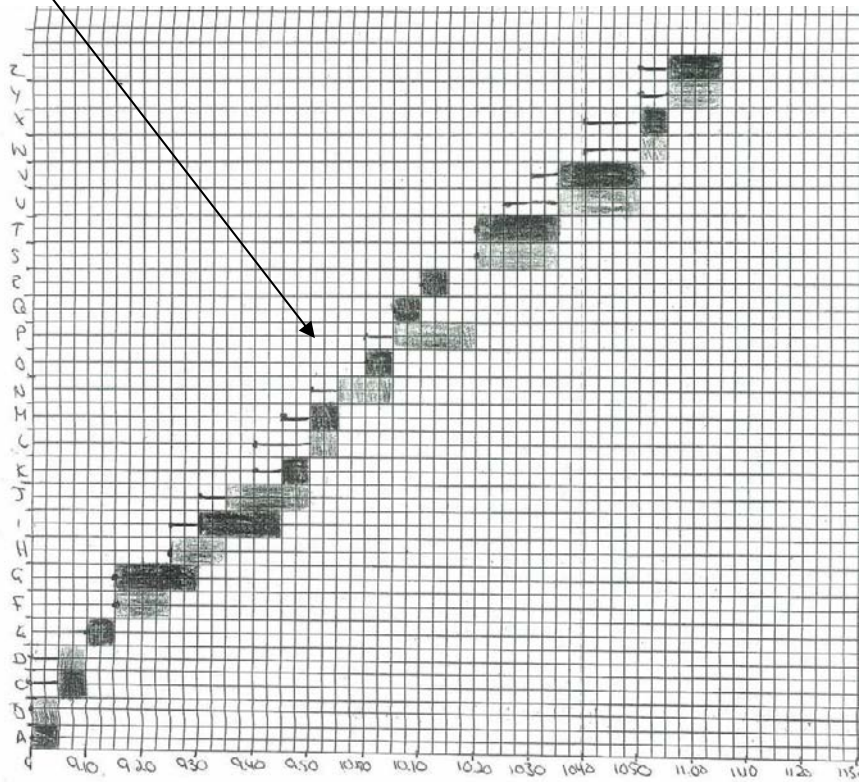
# Standard C

## Task 7



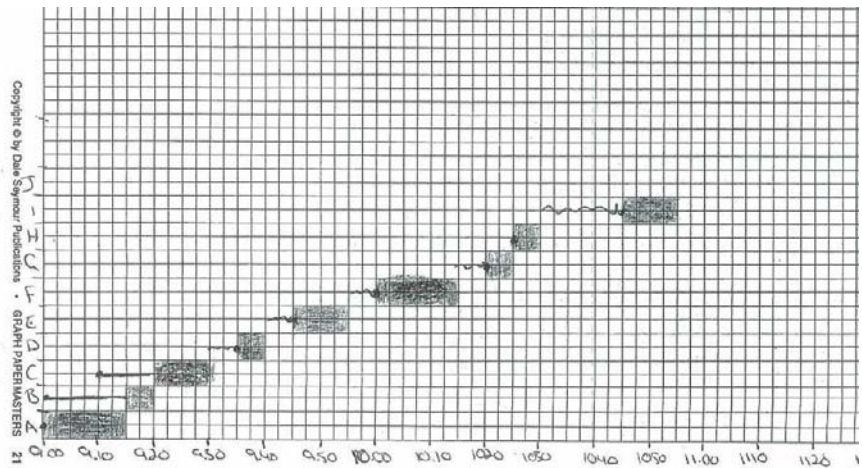
Organisation and presentation of information in a variety of representations in simple non-routine situations

## Task 8 – 2 doctors

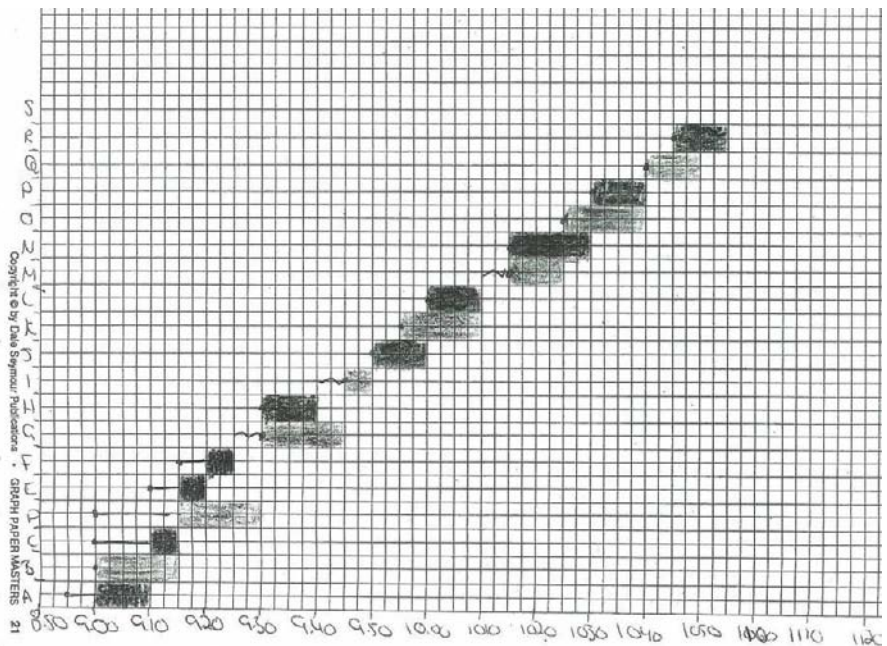


# Standard C

## Task 8 – 15 minute intervals



## Task 8 – 2 doctors and 15 minute intervals



# Instrument-specific criteria and standards

	Standard A	Standard B	Standard C	Standard D	Standard E
Knowledge and procedures	<p>The student's work has the following characteristics:</p> <ul style="list-style-type: none"> <li>application of <b>simple through to complex sequences</b> of mathematical procedures in <b>routine and non-routine situations</b></li> </ul>	<p>The student's work has the following characteristics:</p> <ul style="list-style-type: none"> <li>application of simple sequences of mathematical procedures in non-routine situations or complex sequences in routine situations</li> </ul>	<p>The student's work has the following characteristics:</p> <ul style="list-style-type: none"> <li>application of <b>simple sequences</b> of mathematical procedures in <b>routine situations</b></li> </ul>	<p>The student's work has the following characteristics:</p> <ul style="list-style-type: none"> <li>application of simple mathematical procedures in simple rehearsed situations</li> </ul>	<p>The student's work has the following characteristics:</p> <ul style="list-style-type: none"> <li>attempted use of simple mathematical procedures in simple rehearsed situations</li> </ul>
Modelling and problem solving	<p>The student's work has the following characteristics:</p> <ul style="list-style-type: none"> <li>use of strategies to model and solve problems in <b>complex routine through to simple non-routine</b> situations</li> <li>informed decisions based on mathematical reasoning in <b>complex routine through to simple non-routine</b> situations.</li> </ul>	<p>The student's work has the following characteristics:</p> <ul style="list-style-type: none"> <li>use of strategies to model and solve problems in routine through to simple non-routine queuing situations</li> <li>informed decisions based on mathematical reasoning in routine queuing situations.</li> </ul>	<p>The student's work has the following characteristics:</p> <ul style="list-style-type: none"> <li>use of <b>familiar strategies</b> for problem solving in <b>simple routine</b> situations</li> <li>informed decisions based on mathematical reasoning in <b>simple routine</b> situations.</li> </ul>	<p>The student's work has the following characteristics:</p> <ul style="list-style-type: none"> <li>use of given strategies for problem solving in simple rehearsed queuing situations.</li> </ul>	<p>The student's work has the following characteristics:</p> <ul style="list-style-type: none"> <li>attempted use of given strategies for problem solving in well-rehearsed queuing situations</li> </ul>
Communication and justification	<p>The student's work has the following characteristics:</p> <ul style="list-style-type: none"> <li>organisation and presentation of information in a variety of representations in <b>simple non-routine through to complex routine</b> situations</li> <li><b>analysis and translation</b> of information displayed from one representation to another in <b>complex routine</b> situations</li> </ul>	<p>The student's work has the following characteristics:</p> <ul style="list-style-type: none"> <li>organisation and presentation of information in a variety of representations in simple non-routine and/or complex routine situations</li> <li>analysis and translation of information displayed from one representation to another in simple routine situations</li> </ul>	<p>The student's work has the following characteristics:</p> <ul style="list-style-type: none"> <li>organisation and presentation of information in a variety of representations in <b>simple routine</b> situations</li> <li><b>translation</b> of information displayed from one representation to another in <b>simple routine</b> situations</li> </ul>	<p>The student's work has the following characteristics:</p> <ul style="list-style-type: none"> <li>presentation of information in simple rehearsed situations</li> </ul>	