Sending texts

Applying Mathematical Processes

This **investigation** involves determining the number of text messages sent if four people send texts to each other, and then extending this for different numbers of people.

Suitability Pupils working at all levels; individuals or pairs

Time 30–45 minutes

Equipment
Calculators
Spreadsheet

Resources

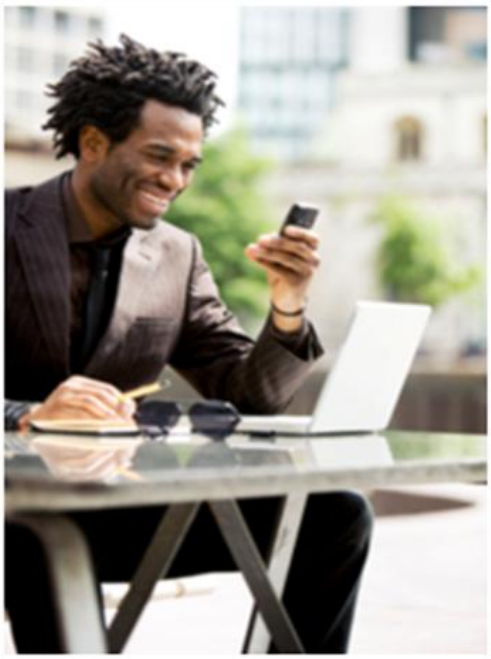
- PUPIL STIMULUS
- TEACHER SUMMARY
- TEACHER GUIDANCE
- PROGRESSION TABLE
- SAMPLE RESPONSES

The Clothworkers' Foundation

Nuffield Foundation

Sending texts

How many texts are sent if **four** people all send texts to each other?



How many texts are sent with different numbers of people?

NUFFIELD APPLYING MATHEMATICAL PROCESSES

TEACHER NOTES Sending texts

Activity description

The activity involves establishing the number of text messages sent if four people send texts to each other, and then extending this to different numbers of people.

Suitability Pupils working at all levels; in groups or individually

Time 30–45 minutes

AMP resources Pupil stimulus

Equipment

Calculators
Spreadsheet

Key mathematical language

Addition, multiplication, variable, algebra, generalisation

Key processes

Representing Choosing method of representation to show the texts sent, and choice of method to establish the number of texts: that is, counting, adding or multiplying.

Analysing Systematic working, using results obtained to make conjectures and generalisations for the number of texts sent by any number of people.

Interpreting and evaluating Forming arguments based on findings, and justifying conclusions.

Communicating and reflecting Communicating findings effectively, relating findings to this and other contexts.

Teacher guidance

Invite four pupils to stand up and enact sending a text to each other. Engage pupils in a whole class discussion about how to represent the activity.

During the activity

If pupils need support in accessing the task, they could model sending texts among four people they know including themselves, using pieces of paper.

Encourage pupils to devise their own recording system. They may need encouragement to collate their findings logically and hence develop a coherent data set.

When pupils recognise that they can group texts by those sending or receiving them, encourage them to use addition, rather than counting, to find the total. When a pupil has established that each person sends/receives the same number of texts, encourage them to see that multiplication is more efficient than repeated addition.

If pupils have found a general rule but are not able to express it without resorting to specific examples, explore with them the use of a letter to represent a variable, such as the number of people.

High attainers may arrive at a generalisation early in the lesson, in which case you may want to engage them with some of the extensions.

Probing questions and feedback

- How might you make your recording system clearer?
- Is there a quicker way of finding the total number of texts sent?
- What links can you find in your results?
- Can you find a general rule?
- Explain your rule to me and then write it down.

Extensions

- Approximately how many text messages would travel in cyberspace if everyone in your school took part?
- How many handshakes would there be if everyone shook hands with everyone else?
- How many matches are played in tournaments for various sports (tennis, chess, football, ...) if it is a league, a knock-out, or a format such as the football World Cup?
- Think of other situations which would give rise to the same or similar mathematical relationships, and explain why.

Progression table

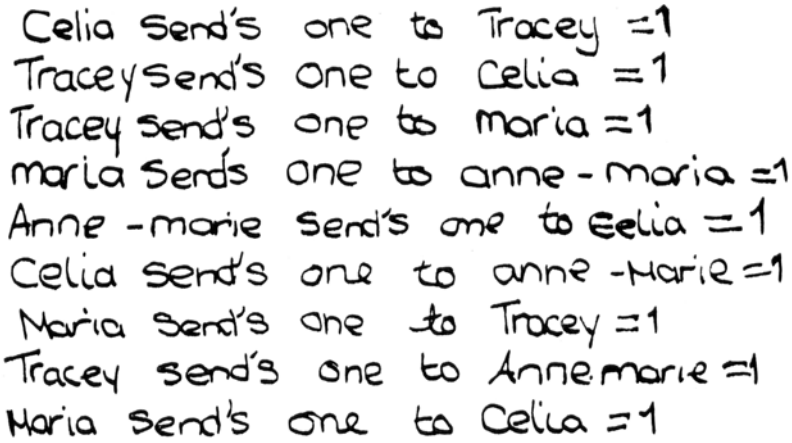
Representing	Analysing	Interpreting and evaluating	Communicating and reflecting
Clear choice of approach	*Use of systems, accuracy of results and spotting patterns*	*Identifies relationships; gives justifications*	*Logical recording of process; justified outcomes; elegant solutions*
Shows understanding of the activity and records some results Pupil A	Finds correct total	Makes a simple observation	Communicates how to find the total
Presents results clearly and consistently e.g. in pictures or diagrams or a table Pupil B	Recognises that the total can be found from repeated addition Pupil C	Makes an observation relating the number of people and the number of texts sent Explains their method for generating results Pupil D	Correctly identifies the number of texts sent for different numbers of people Pupil B, C
Systematically increases the number of people Pupil C, F	Recognises that the total can be found using multiplication Pupil F	Justifies their result for a number of people other than four	Communicates clearly patterns in their results, relating the number of people to the number of texts sent Pupil F
Uses algebra and /or graph with function to represent results Pupil E	Analyses results for varying numbers of people, moving towards a generalisation	Makes and justifies correct generalisation for any number of people Pupil E	Writes a clear and concise account, which shows effectively how the solution was obtained

PROGRESSION

Sample responses

Pupil A

Pupil A demonstrates understanding of the initial task. An incomplete 'list' of events is recorded.



Probing questions

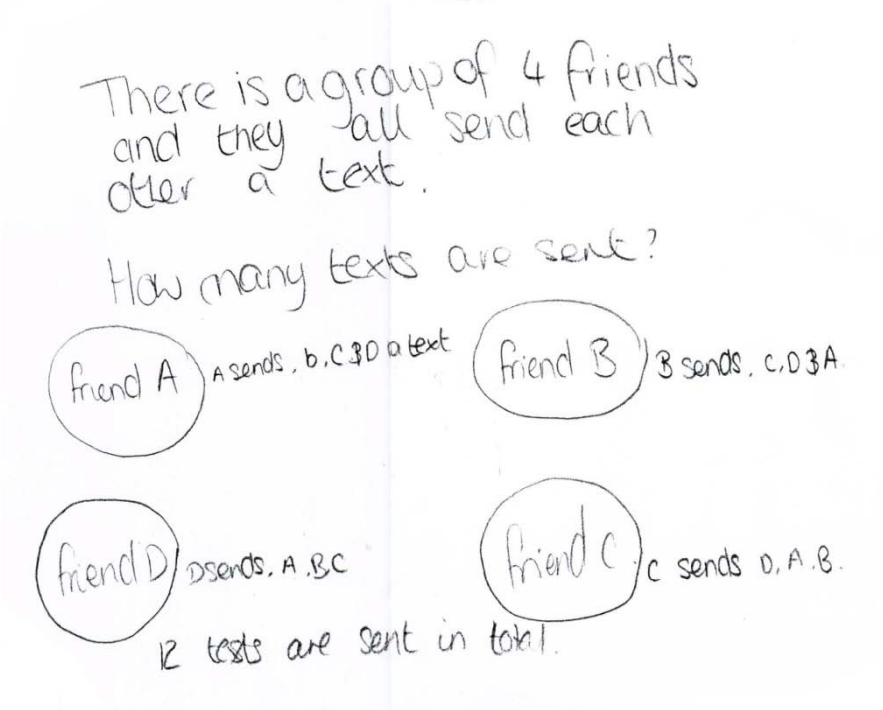
- Could you find a shorter way of writing the texts down?
- How many texts are there altogether?
- How could you check that you have found all the texts?

Pupil B

Pupil B records a complete list of the number of texts sent by each person in a group of four. It is unclear as to whether the pupil used addition or multiplication.

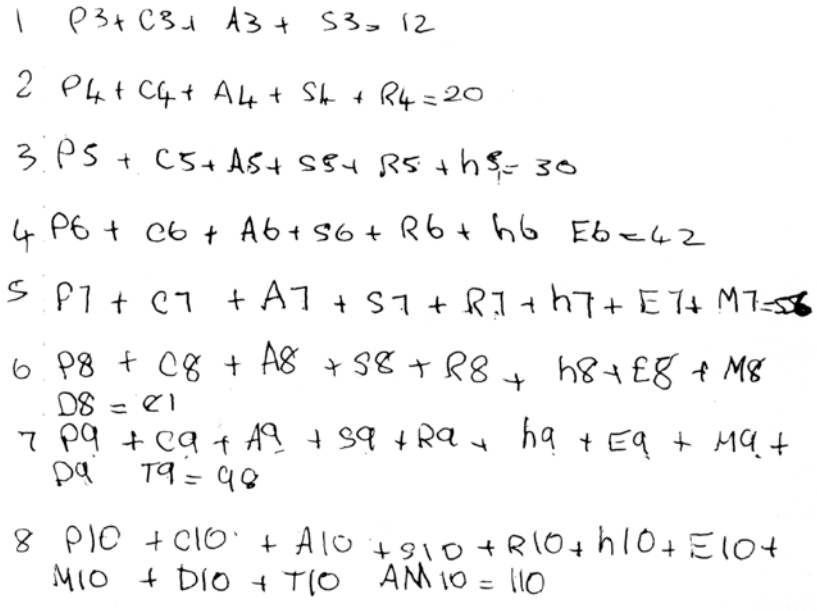
Probing questions

- How did you work out the total?
- How many texts would be sent if a new person, friend E, joined the group?



Pupil C

Pupil C's method of representation enables the correct number of texts to be counted. The results for different numbers of people are explored, using addition to find a total.

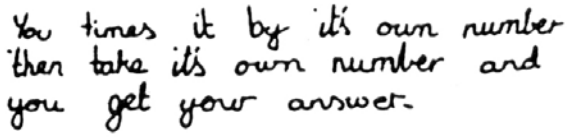


Probing questions

- Is there a quicker way than adding up to find the total number of texts?
- See if you can find a general rule to predict the number of texts.
- Can you then justify your rule?

Pupil D

This pupil gives a general description of their rule, using words.

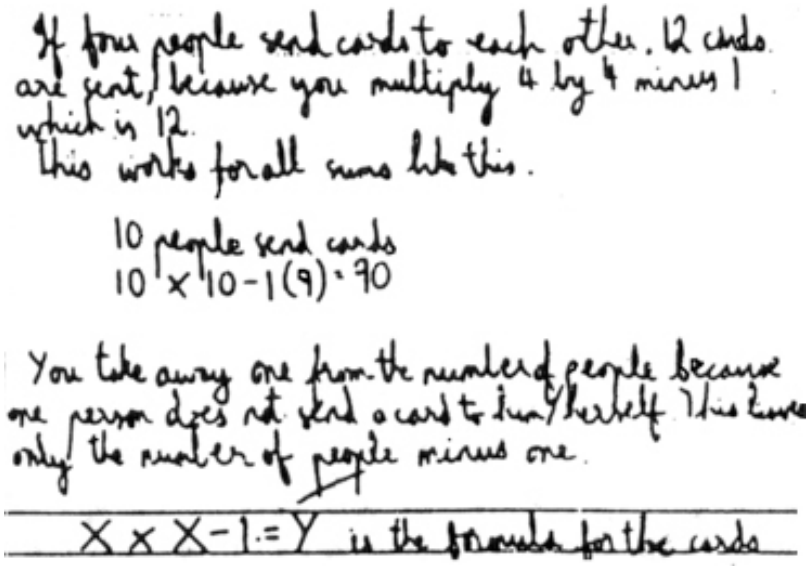


Probing questions

- Why does your rule work?
- Can you express your rule using symbols?

Pupil E

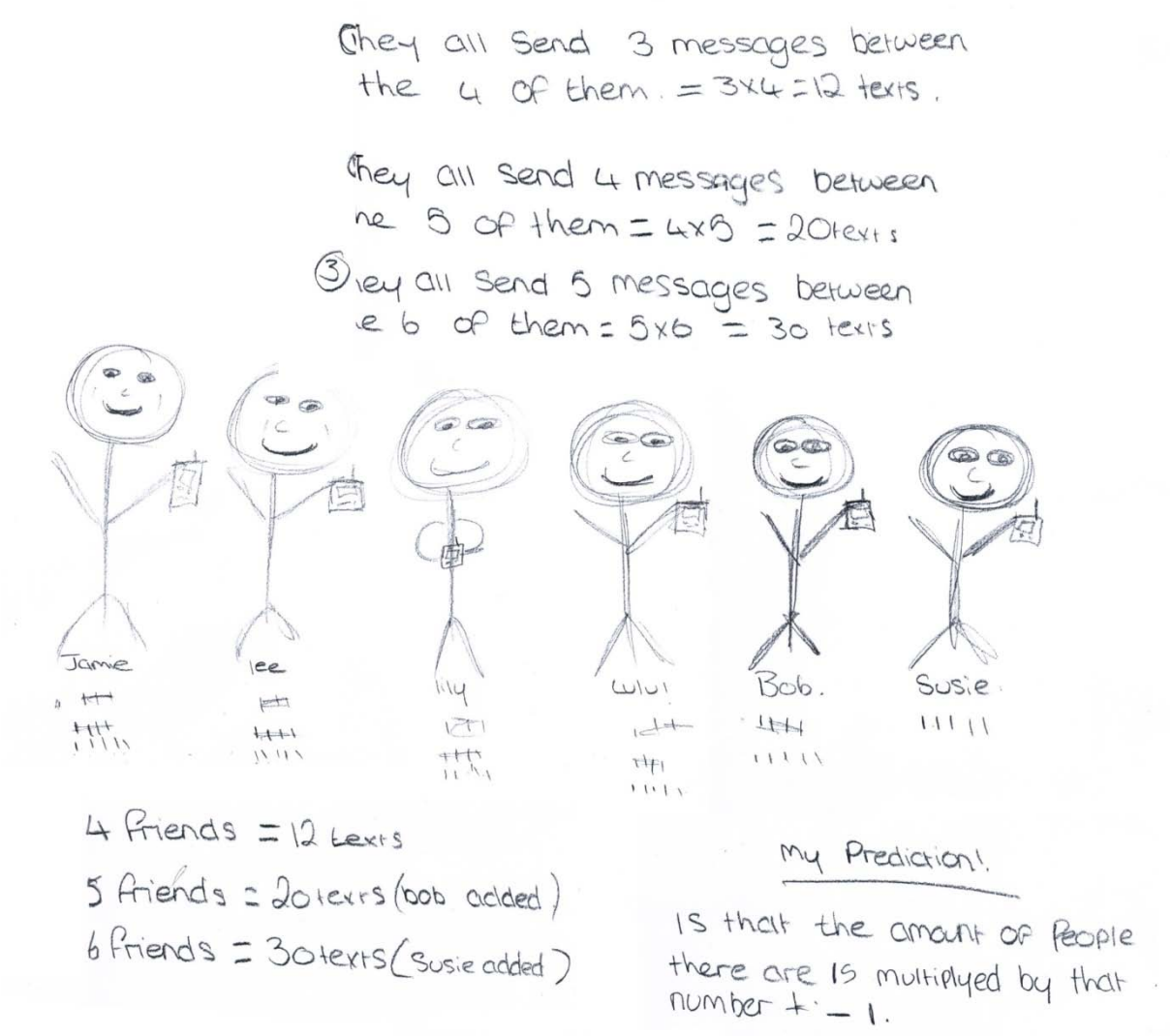
Pupil E describes a generalisation using symbols. The method for calculating the total number of texts is justified, though the reasoning could be communicated better.



Probing question and feedback

- See if you can improve the way you have used algebra to record your final conclusion.
- Describe what the variable *X* stands for.
- See if you can relate your formula to the original problem.

Pupil F



Pupil F began by using pictures of people and tally marks to show the number of texts sent, and multiplication to find the total number sent. Friends are added as the number of friends is increased, rather than drawing a new set of diagrams, making the pictures and tallies not clear to follow. The prediction is accurate, but not explained.

Probing questions

- How can you make it clear what the tally marks in your diagrams stand for?
- Can you explain why your prediction will work?
- Can you write your prediction using symbols?