Teaching and Learning Practices in Secondary Mathematics (Teleprism)

Information about the Survey Methodology and Submitted Datasets

Maria Pampaka & Lawrence Wo

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METHODOLOGICAL OVERVIEW FOR SURVEYS

The project was designed to capture five years of progression (Years 7-11) in slightly over one year of data collection with longitudinal surveys of students (and their teachers) at the beginning and towards the end of the first academic year (2011-2012), and at the beginning of the next academic year (2012-2013). This applies for all five secondary year groups (Year 7-11).

The proposed sampling frame, initially based on the Manchester Challenge initiative, was intended to give a sample that would provide the full spread of national demographic characteristics. Due to unforeseen circumstances with the Manchester Challenge, it was not possible to proceed with this plan, therefore an alternative sampling frame was followed. Schools were thus invited to participate using two main approaches:

1. **School contacts** of the team and other colleagues across the country (this involved schools around Manchester, Nottingham, Calderdale and Wolverhampton).
2. **Schools database** we purchased from a company. We decided to approach schools within 30 miles of various cities (to get a variety of urban/rural schools) across the country. The cities chosen were Manchester, London, Birmingham, Leeds, Bristol, Newcastle, Cambridge and Oxford (only 10 miles to avoid overlap with earlier selections)

In total, we approached over 2200 schools (an example invitation letter is shown in Appendix 1), got expressions of interest to participate from around 70 schools, and finally ended up with the **40 schools** shown in the map below:

The resulting datasets from both pupils and their teachers are provided in different sheets in the data speadsheet, the contents of which are presented in the next sections separately.

THE STUDENT-LEVEL DATASET

The dataset is provided in the long format, that is the data from each data point collection has been pooled together and appended together under the same variables (when applicable). A unique student id (as described below) can be used for converting the file into the wide format.

There are 18170 unique subjects (students) and 30388 records. This includes over 700 classes with 280 teachers in the first year, and over 400 classes at DP3.

The string "#NA" has been used to indicate 'not applicable' for:

1. Questions that did not apply to pupils of certain year groups or data points
2. Schools that did not provide background information at all or for certain fields
3. Self-efficacy items that did not get given to pupils for their particular year group

Other blanks should be treated as missing data, either due to no responses given from students, or information is not provided by the school.

Most of the variables were asked at each data point; whenever this is not the case it will be indicated explicitly in the descriptions below.

VARIABLES FROM PART A: IDENTIFIERS AND BACKGROUND INFORMATION

These are variables with information gathered from **Part A of the student questionnaire**, complimented with some other information useful for matching data over time and across classes and schools.

Variable name	Description (with notes)	Values/Categories
dp	Data point for survey completion	1=October to December 2011 2=June/July 2012 3= October to December 2012
unique_user_number	Unique student identifier. Can be used for matching and converting the dataset to the wide format	In numeric form (N=18170)
source	An indicator of survey administration (i.e. the survey mode)	Hard copy Online generic – no preloaded info Online school – usernames preloaded Online school oldyear – as above but students were given different MSE items (due to admin error)
school_id	Unique School ID. To be used for clustering of students within schools	1 to 40
year_group_se	Year group version for which students completed the questionnaire	1=Year 7 2=Year 8 3=Year 9 4=Year 10 5=Year 11 6=Year 12
year_group	Actual Year group	
year_cohort	The student's cohort at the start of the survey (Oct 2011). New entries at DP3 are defined as	0=Year 7@DP3 1=Year 7 2=Year 8

	cohort 0.	3=Year 9 4=Year 10 5=Year 11
class_id	Unique class ID. These are only valid for use with DP1 and DP2. The IDs associated with DP3 should not be used in the same manner. They could only be used for clustering cross-sectionally.	Combination of text and numeric values, e.g. C03071 The numeric part denotes the school and the year group (i.e. School 3 and Year 7 for above).
teacher1_id	Teacher ID for teacher 1. The same warnings as per class ID apply here.	Combination of text and numeric values, e.g. T0307 The numeric part denotes the school id.
teacher2_id	Teacher ID for teacher 2. The same warnings as per class ID apply here.	As above
dp_teacher_class1	A variable that combines the information for dp, teacher1_id and class_id. Useful for matching with teacher-class level data.	Combination of text and numeric values combing together information on DP, teacher and class.
dp_teacher_class2	A variable that combines the information for dp, teacher2_id and class_id. (as above)	As above
gender	The gender of student.	1 = Male 2 = Female
favourite_subject	Which is your favourite subject in school?	Open responses
least_favourite_subject	Which is your least favourite subject in school?	Open responses
maths_choice	A new variable developed considering the combination of answers in the two previous questions.	0=maths listed as least favourite, 1=not mentioned, 2=maths mentioned as favourite
ability_maths	How do you rate your ability in the following subjects: Maths	1=poor, 2=average, 3=good, 4=excellent
ability_english	How do you rate your ability in the following subjects: English	1=poor, 2=average, 3=good, 4=excellent
ability_science	How do you rate your ability in the following subjects: Science	1=poor, 2=average, 3=good, 4=excellent
The following three variables were only asked at DP2 and DP3, with these questions: How has your ability in these subjects changed since the beginning of the year? (DP2) How has your ability in these subjects changed since last year? (DP3)		
ability_change_maths	Maths	1= worse now 2=same 3=better now
ability_change_english	English	
ability_change_science	Science	
The next variables give responses to: How often do your parents do the following?		
parents1	Check whether you have done your homework	1 = Never 2 = Rarely 3 = Sometimes 4 = Often 5= All the time
parents2	Help you with your homework	
parents3	Praise or reward you for good grades	
parents4	Reduce your rewards because of low grades	
parents5	Find you a tutor to help you with your homework	

VARIABLES FROM PART B OF QUESTIONNAIRE: FEELINGS ABOUT MATHEMATICS

The three variables listed in the table below were only asked with the new cohort (0) year 7 students at DP3.

Variable Name	Question in Questionnaire	Codes
Biggest_Change	What has been the biggest change for you, moving from primary to secondary school?	Open response
Teaching_Change	Has the way you been taught by teachers changed? If so, how?	Open response
Maths_Change	How is mathematics different from primary school?	Open response

The next variables include information gathered from Part B of the student questionnaire (from all students). These items were also used for the construction of the measures of 'maths disposition' and 'maths identity'.

Variable name	Description (with questions)	Values/Codes
	How much do you agree or disagree with the following statements:	
statement1	Mathematics is important to me	1=SD 2=D 3=Unsure 4=A 5=SA
statement2	Most people can learn to be good at maths.	
statement3	My parents/carers like maths.	
statement4	Maths is one of the most interesting school subjects.	
statement5	Learning maths is enjoyable for me.	
statement6	I have a mathematical mind.	
statement7	I can get good results in maths.	
statement8	I am interested in learning new things in maths.	
statement9	In maths you get rewards for your effort.	
statement10	Being good at maths is something you are born with.	
statement11	I can learn maths even if it is hard.	
statement12	I like using maths I am familiar with rather than new maths topics.	
statement13	I am more worried about maths than any other subject.	
statement14	I often need help with maths.	
statement15	Compared to my classmates, I am good at maths.	
statement16	My parents/carers enjoy solving mathematical problems.	
statement17	I never want to take another mathematics course.	
statement18	I would prefer my future studies to include a lot of maths.	
statement19	I would look forward to studying more mathematics after school.	
statement20	I would like to be a mathematician.	
statement21	Maths is important for my future (after school)	

The next two questions and resulting variables are only available for Years 10 and 11.

	Y10 & Y11 ONLY	
more_maths	Are you planning to study any more mathematics courses or units after this GCSE course? (e.g. AS, A2)	1=Yes 2=No 3=I don't know
more_maths_details	If yes, please give details. If no, why not?	Open response

VARIABLES ABOUT STUDENTS' FUTURE DECISIONS AND CHOICES

The following variables resulted from Part C of the questionnaire about student's plans for the future and major influences on their decisions and choices.

Variable name	Description (or questions asked)	Values/Categories
prefer_first_choice	Which of the following options would you prefer to do when you finish Year 11 A. Continue studying at this school B. Study full-time at a college C. Study part-time at a college while working D. Take an apprenticeship (a training course in a practical subject, e.g. plumbing, hairdresser, etc) E. Work in the family business F. Work in a full-time job G. Work in a part-time job H. Other	A to H
prefer_second_choice		A to H
prefer_other	Information regarding 'other' option.	Open
prefer_confidence	How confident are you that you will be able to get your first choice	1=Not at all confident 2=Somewhat confident 3=Very confident

The following two questions were only asked from students in Years 10 and 11.

Variable name	Description (or questions asked)	Values
continue_education	Do you plan to continue your education after Year 11?	1=Yes 2=No 3=I don't know
	If you choose 'Yes', please choose one of the following options:	
continue_education_details	I will continue my education right after Year 11 (GCSEs) in secondary school I will continue my education after staying out of school for one year (or more) I will continue my education, but I don't know when	1= ticked first 2= ticked second 3= ticked third

The following are potential factors that might stop them from continuing their education:

Variable name	Description (or questions asked)	Values/Categories	Notes
	Which of these might stop you from continuing your education after Year 11		
stop1	Low GCSE grades	1 or empty	if ticked the corresponding column is marked with the equivalent number of item
stop2	Parents	2 or empty	
stop3	Friends	3 or empty	
stop4	Other relatives	4 or empty	
stop5	Leaving friends and family	5 or empty	
stop6	Uninterested in studying	6 or empty	
stop7	Care responsibilities	7 or empty	
stop8	Don't know what to do	8 or empty	
stop9	Full-time job	9 or empty	
stop10	Don't like school	10 or empty	
stop11	School not important	11 or empty	
stop12	Not enough money	12 or empty	
stop13	None of the above	13 or empty	

The following variables are about potential influences regarding their decisions, as well as whether other members of their family have been to university.

Variable name	Description (or questions asked)	Values/Categories
	Who will influence or inspire your decisions about what you want to do after Year 11	
influence1	My friends	1=YES 2=Maybe 3=NO
influence2	My parents	
influence3	Teachers	
influence4	My brothers or sisters	
influence5	My cousins	
influence6	Other relatives (aunts, uncles, grandparents)	
influence7	Counsellors at school	
influence8	Other	
influence_details	Information regarding 'other' option.	OPEN
job_description	What job would you like to do in the future?	OPEN
job_reason	Why?	OPEN
go_uni	Do you plan to go to university?	1=Yes 2=No 3=I don't know
uni_course	If you plan to go to university, what subject would you most like to study?	OPEN
	Please also tell us if you know of any people who have been to university by ticking the appropriate box in the following table	
been_uni1	My parents/carers	1=YES 2=NO 3=At uni now 4=I don't know
been_uni2	My brothers or sisters	
been_uni3	My friends	
been_uni4	My cousins	
been_uni5	Other relatives (aunts, uncles, grandparents)	
been_uni6	Other	
been_uni_details	Information regarding 'other' option.	OPEN

VARIABLES ABOUT HOW MATHS IS TAUGHT AND LEARNT (QUESTIONNAIRE PART D)

These variables are from Part D of the questionnaire and aim to capture students' perceptions of the way maths was taught and learnt. Variables "lessons1" to "lessons26" also served as the items in Rasch Modelling of what we called 'perceptions of transmissionist teaching' and 'perceptions of teaching variation' (as described below).

Variable name	Description (or questions asked)	Values/Categories
lessons1	The teacher asks us questions.	1= Never 2=Rarely 3=Sometimes 4=Always
lessons2	The teacher asks us to explain how we get our answers.	
lessons3	The teacher starts new topics with problems about the world.	
lessons4	The teacher tells us to work more quickly.	
lessons5	The teacher uses the computer to teach some topics.	
lessons6	The teacher gives us problems to investigate.	
lessons7	The teacher expects us to remember important ideas learnt in the past.	
lessons8	The teacher tells us which questions/activities to do.	
lessons9	The teacher asks us what we already know about a lesson topic.	
lessons10	The teacher tells us what value the lesson topic has for future use.	
lessons11	We work together in groups on projects.	
lessons12	We listen to the teacher talk about the topic.	
lessons13	We copy the teacher's notes from the board.	
lessons14	We talk with other students about how to solve problems.	
lessons15	We ask other students to explain their ideas.	
lessons16	We do projects (assignments) that include other school subjects.	
lessons17	We work through exercises from the textbook.	
lessons18	We learn how mathematics has changed over time.	
lessons19	What we learn is related with our out-of-school life.	
lessons20	We learn that mathematics is about inventing rules.	
lessons21	We get assignments to research topics on our own.	
lessons22	We use calculators.	
lessons23	We use computers.	
lessons24	We use other things like newspapers, magazines, or video.	
lessons25	We discuss ideas with the whole classroom.	
lessons26	We explain our work to the whole class.	
lesson_difficulty	Most of the time my maths lessons feel:	1=Too easy 2=About right 3=Too hard
	If you use computers or the calculators for your maths lessons, please tell us what are you using them for:	
computers	We use computers for…	OPEN
calculators	We use calculators for…	OPEN

THE MATHEMATICS SELF EFFICACY ITEMS

This section lists all items presented in Section E of the student questionnaire, matched across data points and year group cohorts. A total of 79 items were used all followed by these instructions.

> **Part E- How confident are you with different topics in mathematics?**
>
> In this section, we are asking you to say how confident you would be at using mathematics to solve different problems. **We don't ask you to actually solve the problems.**
>
> Imagine that you have been given the following questions to do. You would be able to use your notes, textbooks, calculator, and so on when necessary. Please tell us how confident you are that you would be able to solve each problem, **without actually doing the problem.**
>
> **How confident are you that you are able to solve problems of the kind given in each case?**
>
> Please circle one response for each task.

The whole list of items' pictures is presented in Appendix 2, in the order they appear in the dataset. All items were coded with the following values:

1=Not confident at all
2=Not very confident
3=Fairly confident
4=Very confident

Appendix 3 lists the items given to each year group at each data point.

THE CONSTRUCTED MEASURES

The next group of 'variables' given in our datasets goes beyond row data and presents the results of the second step of our analytical approach; more details about our comprehensive analytical approach which involves instrument construction, measure validation and analysis see our earlier work (Pampaka, Williams, & Hutchenson, 2012; Pampaka, Williams, Hutcheson, et al., 2012). Therefore we present the results of our validation of certain constructs based on students' responses to previously stated items. This is based on the assumption that there is an underlying construct (or idea/concept) behind the groups of items in the questionnaires, which were brought together after studying previous research literature and looking at other researchers' instruments. Following this with our questionnaires we intended to measure the following ideas/constructs (with the items related to each one presented in the next sections):

- Parental support/involvement
- Attitudes to mathematics
- Mathematics Self-efficacy
- Perceptions (of transmissionist) teaching

Given the students' responses to the relevant questions we then attempt to validate these aforementioned constructs: in other words to check whether they exist as "measures" (or scales), and if not whether there are other dimensions relevant and useful. So, our validation process refers to the accumulation of evidence to support validity arguments regarding the students' reported measures (Messick, 1988, 1989). We employed a psychometric analysis for this purpose, conducted within the Rasch measurement framework, and following relevant proposed guidelines (Wolfe & Smith Jr., 2007a, 2007b). The Rasch rating scale model (using the Winsteps software) is considered the most appropriate for the scaling involved in this project (i.e. a common Likert type scale). Our decisions about the validity of the measures are based on different statistical indices, such as item fit statistics, category statistics, differential item functioning and person-item maps (Andrich, 1999; Bond & Fox, 2001; Thissen, Steinberg, & Wainer, 1993; Wright & Masters, 1982; Wright & Mok, 2000). An example of how these statistical indices are used in order to validate the measure of students' 'perceived parental support/involvement' are shown in Appendix 4, while elsewhere (Pampaka & Wo, 2014) we present details about the construction of maths disposition and 'identity' measures. More details about other measures along with relevant publications will be uploaded in our website (www.teleprism.com).

The next table summarises our constructed measures with reference to the items used, and some broad working definition of the 'construct' developed:

Measure Name	Items used	'Construct' description
parental support	Parents1 to Parents5	Students' perceived parental involvement/support
maths disposition	Statement1, 4, 5, 8, 17, 18, 19, 20 and 21	Measure related to expressions of behavioural intention for future engagement with mathematics (the higher the score the more disposed the student is towards further study or engagement with mathematics
maths identity	Statement2, 3, 6, 7, 11,12,14,15,16	This measure is constructed based on items that express mainly feelings and preferences towards mathematics (the higher the score the more positively/strongly the student relates or identifies with mathematics)
maths self-efficacy	Items in Appendix 2	Confidence in solving mathematical problems
TeachingVariation	Selected items from Lesson 1 to 26	The higher the score on this measure the more diverse the maths lessons from students' perspective
TeachingTransmisionistScale	Selected items from Lesson 1 to 26	The higher the score the more 'traditional' or teacher-centred the practices as reported by the students.

INFORMATION RECEIVED FROM SCHOOLS

The following variables were collected either directly from schools for each of the students in our sample, or derived afterwards from the postcodes of student's address as also given from school. Please note that there are a lot of missing data in regards to these variables, firstly due to non-reporting from schools, and second due to inconsistency of the information given from schools.

There were cases within some schools where 'No's were explicitly stated and in others where it was left blank. This left us with little choice but to treat blanks as missing data.

Variable name	Description	Values/Categories
suggested main	This is our derived simplification of the extended and main ethnicity codes	Asian Black Chinese Information Not Yet Obtained Mixed Other OtherWhite Refused White
extended	These are the DCSF (Department for Children, Schools and Families) extended codes used for ethnicity[1]	Examples: AAFR (African Asian) ABAN (Bangladeshi) AIND (Indian) AKAO (Kashmiri other) AKPA (Kashmiri Pakistani) AMPK (Mirpuri Pakistani) ANEP (Nepali)
main	DCSF Main Code[2]	ABAN AIND AOTH APKN BAFR BCRB BOTH CHNE MOTH MWAS MWBA MWBC NOBT OOTH REFU WBRI WIRI WOTH
fsm	Free School Meal Eligibility	Y=Yes N = No
sen_yn	Whether the student has an SEN	Y = if school indicated SEN generally or by giving details N = if explicitly stated by school
sen details	SEN details for those with Yes in previous variable, when available	ASD = Autistic Spectrum Disorder BESD = Behaviour, Emotional & Social Difficulties HI = Hearing Impairment MLD = Moderate Learning Difficulty

[1] Detailed description is given at http://www.communitycohesionncc.org.uk/docs/57.pdf
[2] See http://www3.hants.gov.uk/codes-ethnicbackgrounds.pdf for descriptions

		MSI = Multi-Sensory Impairment OTH = Other Difficulty/Disability PD = Physical Disability PMLD = Profound & Multiple Learning Difficulty SLCN = Speech, Language and Communication Needs SLD = Severe Learning Difficulty SPLD = Specific Learning Difficulty VI = Visual Impairment
first language	Language of first choice	ENB = Not known but believed to be English ENG = English NOT = Information not obtained OTB = Not known but believed to be other than English OTH = Other than English PEN = Classification pending REF = Refused
RANK OF IMD SCORE	Index of Multiple Deprivation (IMD) rank is an index of wellbeing and deprivation based on postcode	Integer rank (1 is most deprived)
Acorn Category[3]	Most broad category of demographics from Acorn classifications.	Affluent Achievers Comfortable Communities Financially Stretched Rising Prosperity Urban Adversity Not Private Households
Acorn Group	Acorn categories are divided into several groups	Career Climbers City Sophisticates Comfortable Seniors Countryside Communities Difficult Circumstances Executive Wealth Lavish Lifestyles Mature Money Modest Means Poorer Pensioners Starting Out Steady Neighbourhoods Striving Families Struggling Estates Student Life Successful Suburbs Young Hardship
ACORN TYPE	Demographic type code	1 to 62
Acorn Type2	Each group is also divided into more specific types.	Examples: Affluent professionals Asset rich families Better-off villagers **Note:** the whole list is presented in Appendix 5
POLAR3qYPR	Quintiles for young participation rate (Higher Education)	1=lowest participation 2 3 4 5=highest participation

[3] In **Appendix 5** we summarise the information from the Accorn types in a table.

TEACHER-CLASS LEVEL DATASET

This dataset includes the responses to the teacher survey relevant to a particular class. The teachers were asked to complete this section for as many classes they teach (and take part in the student survey) which gives rise to multiple class occasions for the same teacher. They were also asked to do this at various times during the academic year (to ideally match data points 1 and 2 of the student surveys). Background information for the teachers is included in the 'teacher-level dataset'. The variables in the next table are identifiers and relevant to the class characteristics/information.

Variable name	Description	Values/Categories
dp	Data collection data point (as per student dataset)	1= DP1 2= DP2
submit_date	Data of completion	Date
teacher_id	Teacher id as per student dataset	Example: T0101
school_id	School ID as per student dataset	1 to 40
class_id	Class ID as per student dataset	Example: C01101
dp_teacher_class	A variable that combines the information for dp, teacher1_id and class_id. Useful for matching.	Example: 1T0108C01102
year	Year group of class	7 = Year 7 8 = Year 8 9 = Year 9 10 = Year 10 11 = Year 11 12 = Year 12
number_of_students	Number of students in class	Numeric value [3 to 34]
class_changed	[This was only asked at DP2]. Has this class changed since the beginning of the academic year?	1=yes 2=no
class_changed_how	If YES, please briefly describe how it changed:	OPEN
only_teacher	Are you the only teacher of this class?	1=yes 2=no
	Which of the following best describes the ability of the students in this class relative to the other students in this school?	
class_ability	Fairly homogeneous (setted) and low in ability [1] Fairly homogeneous (setted) and average in ability [2] Fairly homogeneous (setted) and high in ability [3] Mixed ability with two or more ability levels [4] Other setting, [5]	1 2 3 4 5
class_ability_other	If 'other' please describe:	OPEN
	Please indicate if any of the students in this mathematics class are formallly classified as each of the following:	
sen_1	Specific learning difficulty (e.g. dyslexia, dyspraxia)	1 if ticked, else empty
sen_2	Other learning difficulties (e.g. moderate LD, autistic spectrum disorders)	2 if ticked, else empty
sen_3	Sensory and/or physical needs (hearing, visual etc.)	3 if ticked, else empty
sen_4	Behavioural, emotional and social difficulties	4 if ticked, else empty
sen_5	English as an Additional Language (EAL)	5 if ticked, else empty

The next table lists the items aiming to capture teaching practices. These were followed by the instruction “About how often do you do each of the following in your mathematics instruction in this class?” They were also used for the construction of the two measures (see later).

Variable name	Description	Values/Categories
teaching_1	I introduce a new topic by first determining what the students already know about it	1=Rarely 2=Sometimes 3=Often 4=Always
teaching_2	I offer content matter in gradually increasing levels of complexity	
teaching_3	I teach each topic from the beginning, assuming they know nothing	
teaching_4	I teach the whole class at once	
teaching_5	I jump between topics as the need arises	
teaching_6	I have my students work collaboratively in pairs	
teaching_7	I have my students work collaboratively in groups	
teaching_8	I teach each student differently according to individual needs	
teaching_9	I encourage students to discuss the mistakes they make	
teaching_10	I tend to follow the textbook closely	
teaching_11	Students work on projects in which subject material from various subjects is integrated	
teaching_12	Students decide for themselves whether it is necessary to cooperate with other students	
teaching_13	Students engage in mathematical activities using concrete materials	
teaching_14	Students make formal presentations to the rest of the class	
teaching_15	Students work on extended mathematics investigations or projects (a week or more in duration)	
teaching_16	Students start with easy questions and work up to harder questions	
teaching_17	Students read from a mathematics textbook in class	
teaching_18	Students use mathematical concepts to interpret and solve applied problems	
teaching_19	Students play mathematics games	
teaching_20	Students work through exercises from textbooks or worksheets	
teaching_21	Students work on their own, consulting a neighbour from time to time	
teaching_22	Students choose which questions to tackle	
teaching_23	I choose examples that appeal to students	
teaching_24	I try to indicate the value of each lesson topic for future use	
teaching_25	When a student asks a question, I give a clue (or scaffold) instead of the correct answer	
teaching_26	During instruction I ask a lot of short questions to check whether students understand the content matter	
teaching_27	I assign mathematics homework	
teaching_28	I ask students to explain their reasoning when giving an answer	
teaching_29	I encourage students to explore alternative methods for solutions	
teaching_30	I allow students to work at their own pace	

The variables in the following table were only asked at DP2 (therefore they are not included in the electronic copy of the survey).

Variable name	Description	Values/Categories
	How is the total overall teaching time spent for this class during this year? Please report the percentage for each general activity:	
time_presentation	Teacher talk/lesson presentation:	Percentage value
time_individual_work	Student work/talk:	Percentage value
time_ts_interaction	Teacher- student interaction:	Percentage value
time_ss_interaction	Student-student interaction:	Percentage value
time_total	Total time	100 (for all cases)

The final questions in the teacher survey, regarding the specific class, are listed below. The last two variables in the table are the constructed measures (using the teaching practice items presented in previous tables).

Variable name	Description	Values/Categories
	Think about your plans for this mathematics class for the entire year. How much emphasis will each of the following student objectives receive?	
emphasis_1	Increase students' interest in mathematics	1=Minimum 2=Moderate 3=Maximum
emphasis_2	Learn mathematical concepts	
emphasis_3	Learn mathematical algorithms/procedures	
emphasis_4	Develop students' computational skills	
emphasis_5	Learn how to solve problems	
emphasis_6	Learn how mathematics ideas connect with one another	
emphasis_7	Prepare for further study in mathematics	
emphasis_8	Learn to explain ideas in mathematics effectively	
emphasis_9	Learn how to apply mathematics in business and industry	
emphasis_10	Prepare students for standardized tests/exams	
as_you_liked	Has your teaching with this class been as you would like it to be?	1=Yes 2=No
problems	If NOT, please tell us what has been the main problems/barriers for this	OPEN
other_comments	Please give any other comments here:	OPEN
Constructed measures with the Rasch Model :		
TVariation	The higher the score the more varied the teaching practice with this class	In logit scale
TTransmissionist	The higher the score the more 'transmissionist' the teaching practice with this class	In logit scale

TEACHER-LEVEL DATASET

This dataset includes the variables related to the particular teacher. They denote background information and were only asked once.

Variable name	Description	Values/Categories
teacher_id	Teacher ID for linking to student level data	
school_id	School ID	1-40
gender	The gender of the teacher	1=male 2=female
ethnicity	Ethnicity of the teacher 1 = White British 2 = White Irish 3 = Other White Background* 4 = Mixed - White and Black Caribbean 5 = Mixed - White and Black African 6 = Mixed - White and Asian 7 = Other Mixed Background* 8 = Asian or Asian British - Indian 9 = Asian or Asian British - Pakistani 10 = Asian or Asian British - Bangladeshi 11 = Other Asian Background* 12 = Black or Black British - Caribbean 13 = Black or Black British - African 14 = Other Black Background* 15 = Chinese 16 = Other Ethnic Background* 17 = Not known 18 = Prefer not to say	1-18
ethnicity_other	Further details on ethnicity	OPEN
dob_year	Year of birth of teacher	Integer
	Which of the following qualifications do you have? (tick all that apply)	
quali_1	Undergraduate degree in Maths (BA, BSc)	1
quali_2	Joint undergraduate degree in Maths and Other Subject	2
quali_3	Undergraduate degree in Education	3
quali_4	Undergraduate degree in Engineering	4
quali_5	Undergraduate degree in Science	5
quali_6	Other undergraduate degree*	6
quali_7	PGCE Secondary Mathematics	7
quali_8	Other PGCE course*	8
quali_9	Other postgraduate degree (MA, MSc, not PGCE)*	9
quali_10	Doctorate (PhD)	10
quali_other	Details of other degree qualification	OPEN
no_course	If they had never taken a mathematics course	1=Never
years_teaching	Number of years teaching	Integer
In the last 2 years, have you received training in these areas from any source or taken part in any of the activities?		
training_1	Trained in the use of computers and technology	1=Yes 2=No
training_2	Trained in the integration of computers and other technology into the classroom curriculum	

training_3	Follow-up or advanced training	
training_4	Taught any in-service workshops in mathematics or mathematics teaching?	
training_5	Mentored another teacher as part of a formal arrangement that is recognized or supported by the school or district, not including supervision of student teachers?	
training_6	Received any grants or awards for mathematics teaching?	
training_7	Served on a school or local authority mathematics curriculum committee?	
training_other	Other training they have received	OPEN
When students are successful in achieving intended goals or objectives, it is often attributed to one of the following sources. In your opinion, how important is each source of success?		
importance_1	Student's home background	1=Unimportant 2=Important 3=Very important
importance_2	Student's intellectual ability	
importance_3	Student's enthusiasm or perseverance	
importance_4	Teacher's attention to the unique interests and abilities of the student	
importance_5	Teacher's use of effective methods of teaching	
importance_6	Teacher's enthusiasm or perseverance	
can_learn_maths	Most people can learn to be good at math	1 = Strongly disagree 2 = Disagree 3 = Unsure 4 = Agree 5 = Strongly agree
born_maths_ability	You have to be born with the ability to be good at math	

REFERENCES

Andrich, D. (1999). Rating Scale Model. In G. N. Masters & J. P. Keeves (Eds.), *Advances in Measurement in Educational Research and Assessment* (pp. 110 - 121). Oxford: Pergamon.

Bond, T., & Fox, C. M. (2001). *Applying the Rasch Model: Fundamental Measurement in the Human Sciences*. Mahwah, NJ: Lawrence Erlbaum.

Messick, S. (1988). The Once and Future Issues of Validity: Assessing the Meaning and Consequences of Measurement. In H. Wainer & H. I. Braun (Eds.), *Test Validity* (pp. 33-45). London: Lawrence Erlbaum Associates, Publishers.

Messick, S. (1989). Validity. In R. L. Linn (Ed.), *Educational Measurement* (Third ed., pp. 13-103). USA: American Council of Education and the Oryx Press.

Pampaka, M., Williams, J., & Hutchenson, G. (2012). Measuring students' transition into university and its association with learning outcomes. *British Educational Research Journal, 38*(6), 1041-1071.

Pampaka, M., Williams, J. S., Hutcheson, G., Wake, G., Black, L., Davis, P., & Hernandez - Martinez, P. (2012). The association between mathematics pedagogy and learners' dispositions for university study. *British Educational Research Journal, 38*(3), 473-496.

Pampaka, M., & Wo, L. (2014). *Revisiting Mathematical Attitudes of students in Secondary Education. In Liljedahl, P., Oesterle, S., Nicol, C., & Allan, D. (Eds.) Proceedings of the Joint Meeting of PME 38 and PME-NA 36, Vol. 4, pp. 385-392. .* Paper presented at the The Joint Meeting of PME 38 and PME-NA 36, Canada, Vancouver.

Thissen, D., Steinberg, L., & Wainer, H. (1993). Detection of Differential Item Functioning Using the Parameters of Item Response Models. In P. W. Holland & H. Wainer (Eds.), *Differential Item Functioning* (pp. 67-114). London Lawrence Erlbaum Associates, Publishers.

Wolfe, E. W., & Smith Jr., E. V. (2007a). Instrument Development Tools and Activities for Measure Validation Using Rasch Models: Part I - Instrument Development Tools. *Journal of Applied Measurement, 8*(1), 97-123.

Wolfe, E. W., & Smith Jr., E. V. (2007b). Instrument Development Tools and Activities for Measure Validation Using Rasch Models: Part II - Validation Activities. *Journal of Applied Measurement, 8*(2), 204-234.

Wright, B. D., & Masters, G. N. (1982). *Rating Scale Analysis*. Chicago: MESA Press.

Wright, B. D., & Mok, M. (2000). Rasch Models Overview. *Journal of Applied Measurement, 1*(1), 83-106.

APPENDICES

APPENDIX 1 – EXAMPLE INVITATION LETTER

Dear Teacher/Headteacher,

Would your school be interested in participating in a research project looking at improving maths teaching in secondary schools? If you would like to be involved in the project, then please contact me via email. Equally, if you would like to hear more about the project before making a decision, we would be very happy to visit you to talk in more depth about it, so please let us know. The project will begin in September 2011.

There is also a pilot stage in June 2011, mainly for testing our questionnaires and online survey tool, so please let us know if you would also be happy for us to pilot the survey in your school.

In short, the project is about secondary school mathematics teaching and learning (more details attached). We aim to map pedagogy and learner outcomes across a range of schools, through an (online) survey of students and teachers, which we plan for the next academic year (2011-12). In particular, we hope to collect data from students in Year 7 to Year 11 three times a year (1. At the beginning of academic year 2011-12, 2. Towards the end of the same academic year, and 3. At the beginning of the following academic year) to be able to map their progression in mathematics. At the same time, we are hoping to collect teachers' perceptions about their teaching with these students during the first year of the project.

In terms of impacting on maths pedagogy in your school, we are confident that with this design we will be able to help your school collect evidence of what is working in mathematics pedagogy, where, and why. You can have access to your school's data (of course conforming with the ethical assumptions of anonymity and confidentiality) and also our general results which will inform on students' attitudes to mathematics and their association with the reported pedagogical experience. In addition, there is going to be opportunities to join a network of mathematics teachers discussing these results (with at least two events sponsored from the projects and others to be negotiated).

In addition to the questionnaires, we also plan to have mini case studies in some schools, with interviews and observations of mathematics lessons. This will be decided once the project is underway but if you think you might be interested in this part of the research then please also let us know.

We are sending out this letter to all the secondary head teachers/mentors of PGCE students at the University X as we know many of you have worked closely with some of our colleagues from the School of Education on other occasions.

I look forward to hearing from you and please do not hesitate to contact me if you have any queries.

Kind regards

Maria

APPENDIX 2 – THE MATHEMATICS SELF EFFICACY ITEMS

The list presented here is to help match the items with the final dataset, and we thus present them in this order. It may be useful for some users to also draw on the particular questionnaires (hard copies) for each of the year group and data point.

This section was always starting with the following instructions:

Part E- How confident are you with different topics in mathematics?

In this section, we are asking you to say how confident you would be at using mathematics to solve different problems. **We don't ask you to actually solve the problems.**

Imagine that you have been given the following questions to do. You would be able to use your notes, textbooks, calculator, and so on when necessary. Please tell us how confident you are that you would be able to solve each problem, **without actually doing the problem.**

How confident are you that you are able to solve problems of the kind given in each case?

Please circle one response for each task.

MSE1

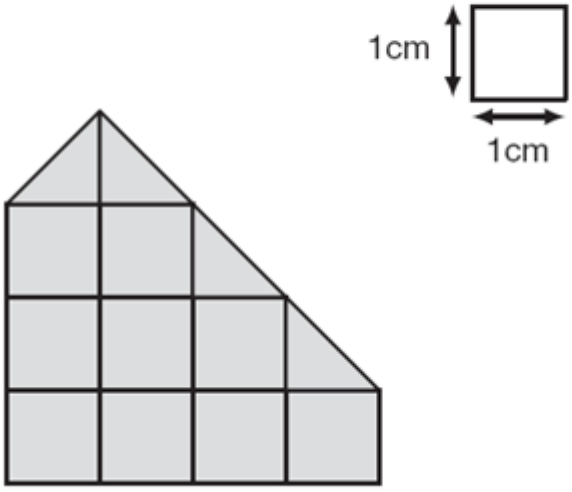
Mike asked his friends which feature they used most on their mobile phones.
He recorded the results in a tally table.

(a) Complete the frequency column in the table below.
The first two values are done for you.

Feature	Tally	Frequency
Phone calls	𝍸 ||	7
Texts	|||	3
Photos	𝍸 𝍸 ||	
Internet	𝍸 𝍸	
Games	||||	

MSE2

What is the **area** of the shaded shape in square centimetres?



MSE3

Calculate
(–24) ÷ (+6)

MSE4

Calculate
(–6) – (+3)

MSE5

A brother and sister have a total age of 20 years.
The brother is aged n years old.
Circle the expression for the sister's age.

$n - 20$ $n + 20$ $20 - n$ $20n$ $20 / n$

MSE6

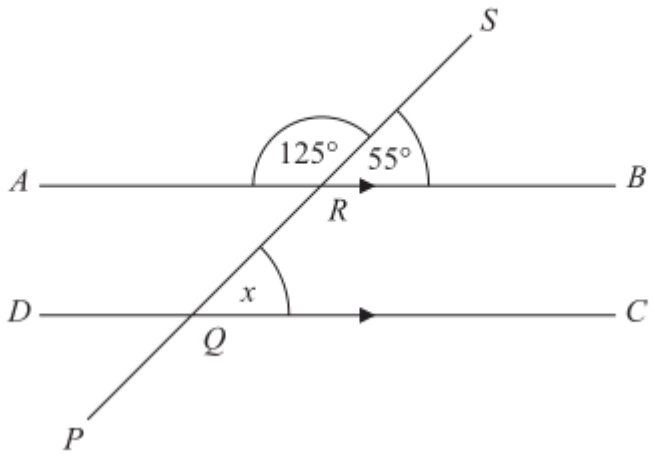


Diagram **NOT** accurately drawn

ARB is parallel to *DQC*.

PQRS is a straight line.

Angle *SRB* = 55°.

(i) Find the size of the angle marked *x*.

.....°

MSE7

The *n*th term of a number sequence is given by $3n+1$

(a) Work out the first **two** terms of the number sequence.

.....

(1)

MSE8

Here are the first four terms of another number sequence.

1 5 9 13

(b) Find, in terms of n, an expression for the nth term of this number sequence.

.....

(2)

MSE9

Here are the ages, in years, of 16 people.

36	48	18	25	36	28	45	30
38	27	41	16	36	48	28	21

(b) Find the median age.

..... years

(2)

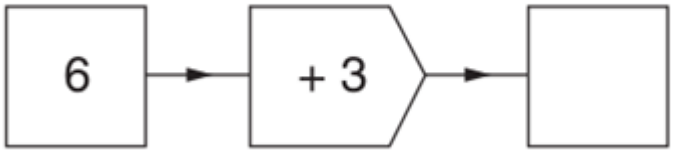
MSE10

Mr Gordon pays for a family holiday.
(a) Complete his bill.

Description	Cost
2 adults @ £540 each	
3 children @ £250 each	
Hire of car for 10 days @ £20 per day	
Total	£

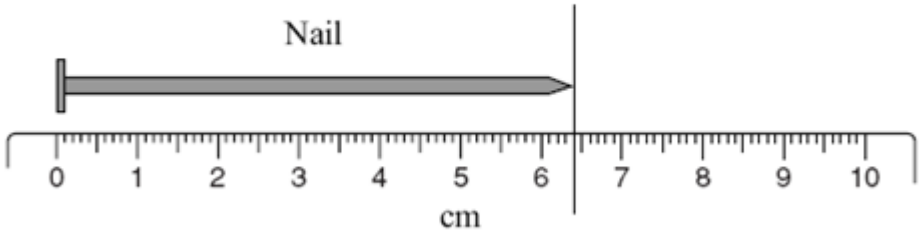
MSE11

Complete the number machine calculation by filling in the empty box.

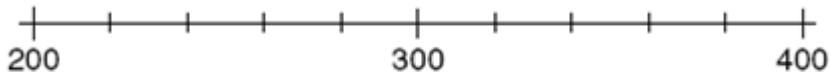


MSE12

How long is the nail?



MSE13



On this number line, mark the position of 270.

MSE14

PQR is a right-angled triangle.

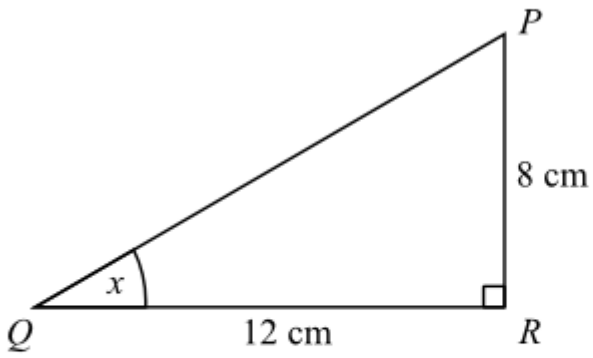


Diagram **NOT** accurately drawn

PR = 8 cm.
QR = 12 cm.

Find the size of the angle marked *x*.
Give your answer correct to 1 decimal place.

MSE15

This frequency table gives information about the ages of 60 teachers.

Age (A) in years	Frequency
$20 < A \leq 30$	12
$30 < A \leq 40$	15
$40 < A \leq 50$	18
$50 < A \leq 60$	12
$60 < A \leq 70$	3

a) Complete the cumulative frequency table.

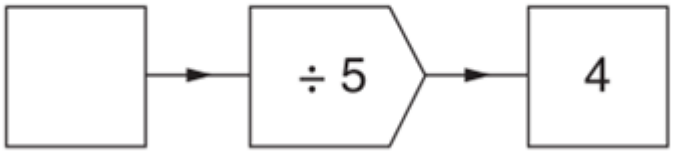
Age (A) in years	Cumulative frequency
$20 < A \leq 30$	
$30 < A \leq 40$	
$40 < A \leq 50$	
$50 < A \leq 60$	
$60 < A \leq 70$	

MSE16

In a quiz there are ten questions.
Each correct answer gains five points.
Each wrong answer loses two points.
Glen gave seven correct answers and three wrong answers.
How many points did he get altogether?

MSE17

Complete the number machine calculation by filling in the empty box.



MSE18

Simplify $2x + 8 + 4x - 3$

MSE19

Solve this equation

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

MSE20

Calculate 36% of £420.

MSE21

Complete the table of values for $y = 3x + 4$

x	0	1	2	3	4	5
y	4		10		16	19

MSE22

Calculate $\dfrac{4.5}{0.6^2}$

MSE23

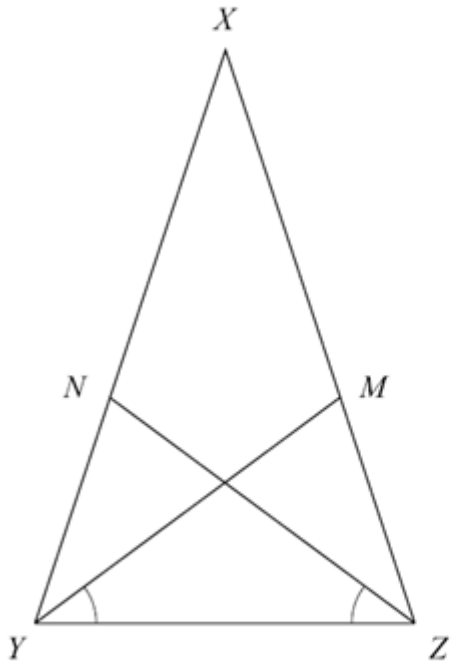
Work out $4\frac{1}{5} - 1\frac{2}{3}$

MSE24

Simplify $\dfrac{2(x+3)^2}{8(x+3)}$

MSE25

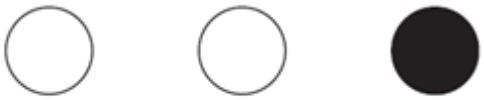
XYZ is an isosceles triangle in which $XZ = XY$
M and N are points on XZ and XY such that angle MYZ = angle NZY



Prove that triangles YMZ and ZNY are congruent.

MSE26

Aidan puts 2 white counters and 1 black counter in a bag.

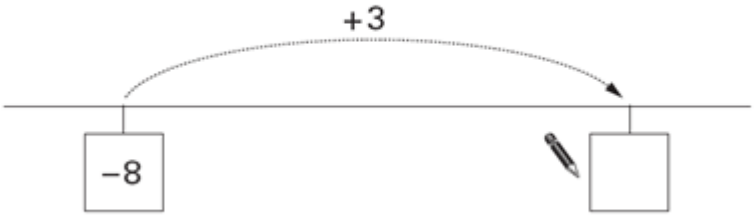


He is going to take one counter without looking.

What is the **probability** that the counter will be **black**?

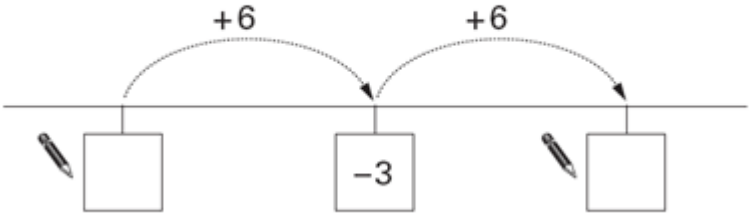
MSE27

Write the missing number on the number line



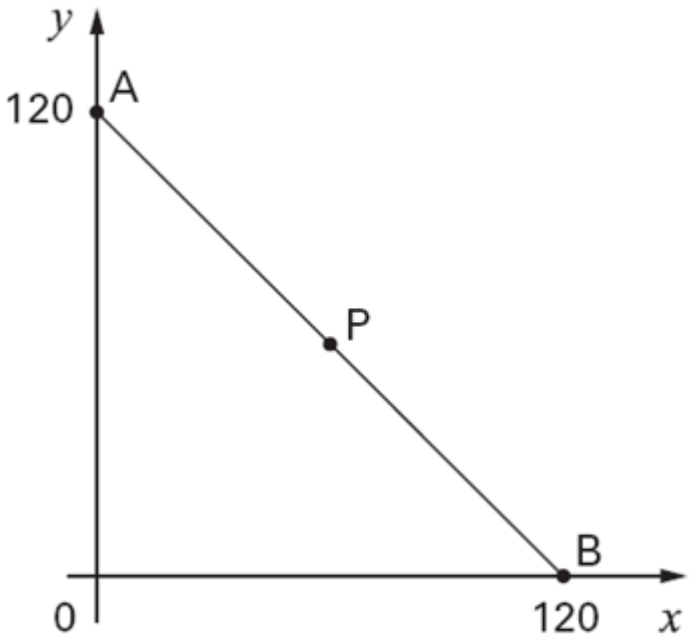
MSE28

Write the missing numbers on the number lines



MSE29

P is the **midpoint** of line AB.



What are the coordinates of point **P**?

MSE30

(a) Write the number 4117 in words.

.....

(1)

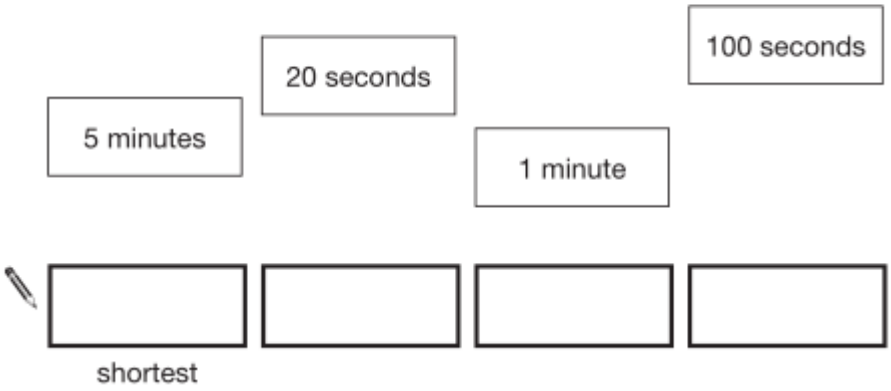
(b) Write the number 4117 to the nearest hundred.

.....

(1)

MSE31

Put these times in order, starting with the shortest.



MSE32

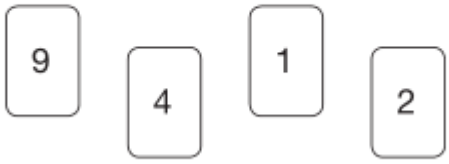
Here is a number chart.

Circle the **smallest** number on the chart that is a multiple of **both** 2 and 7

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

MSE33

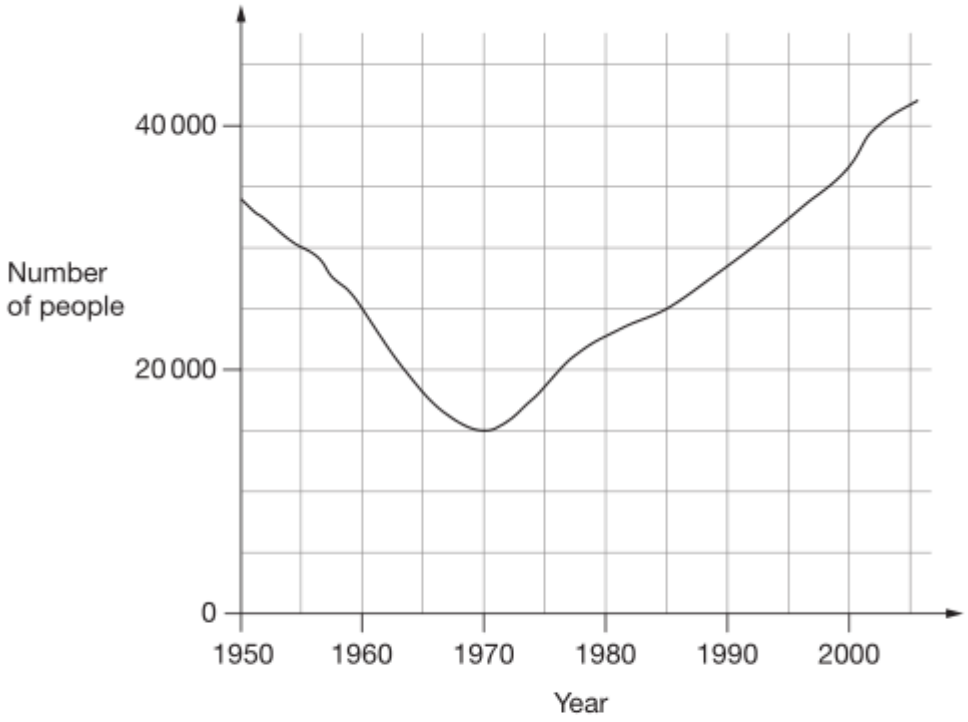
Here are four digit cards.



Use each digit card **once** to make the decimal number **nearest to 20**

MSE34

20 This graph shows the number of people living in a town.

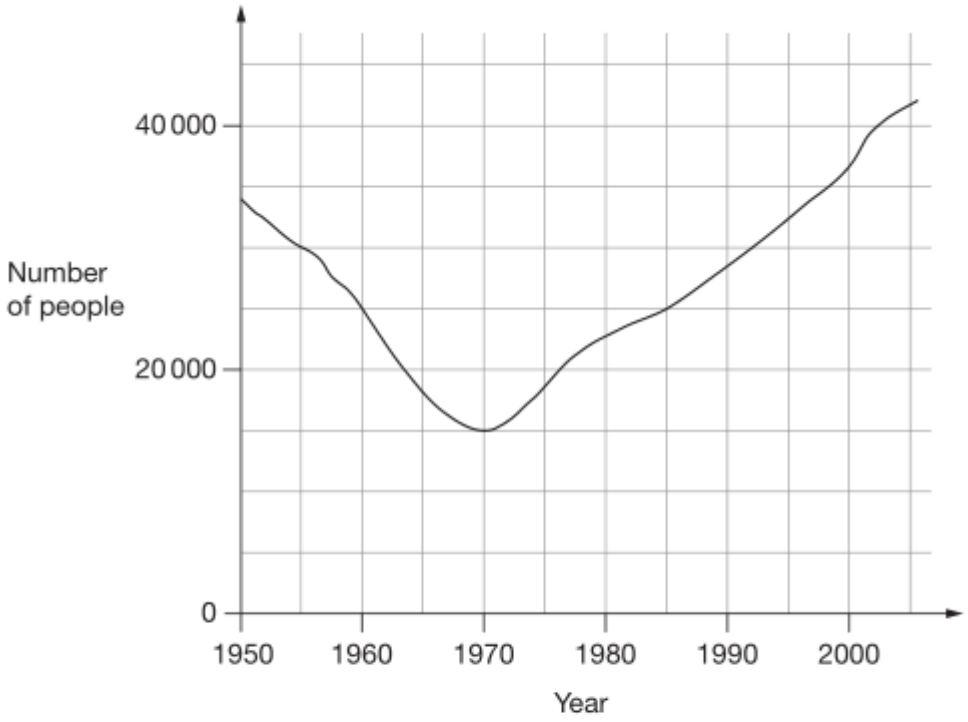


Look at the graph.

How many people lived in the town in 1985?

MSE35

20 This graph shows the number of people living in a town.

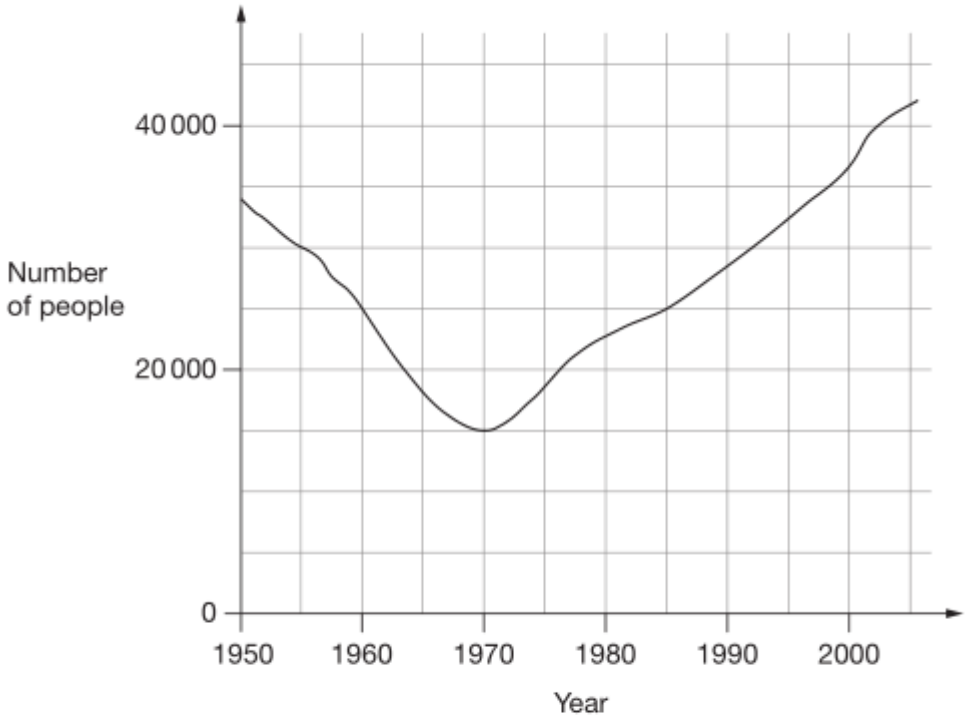


Look at the graph.

In which year was the number of people the same as in 1950?

MSE36

20 This graph shows the number of people living in a town.



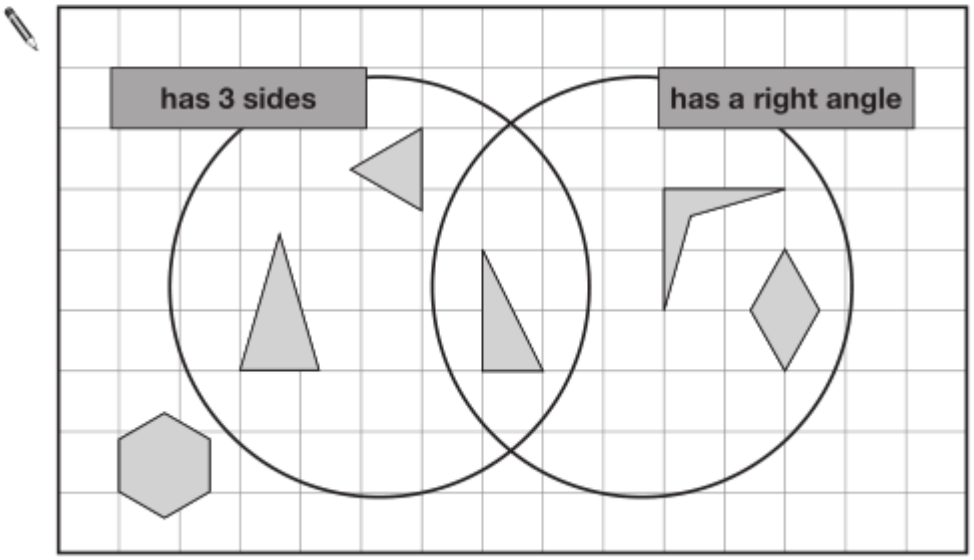
Look at the graph.

Find the year when the number of people first went below 20 000

MSE37

Here is a diagram for sorting shapes.

One of the shapes is in the wrong place.
Put a cross (✗) on it.



MSE38

Emily has these coins.

How much more money does Emily need to make exactly £5?

£

MSE39

Amir says,

'All numbers that end in a 4 are multiples of 4'.

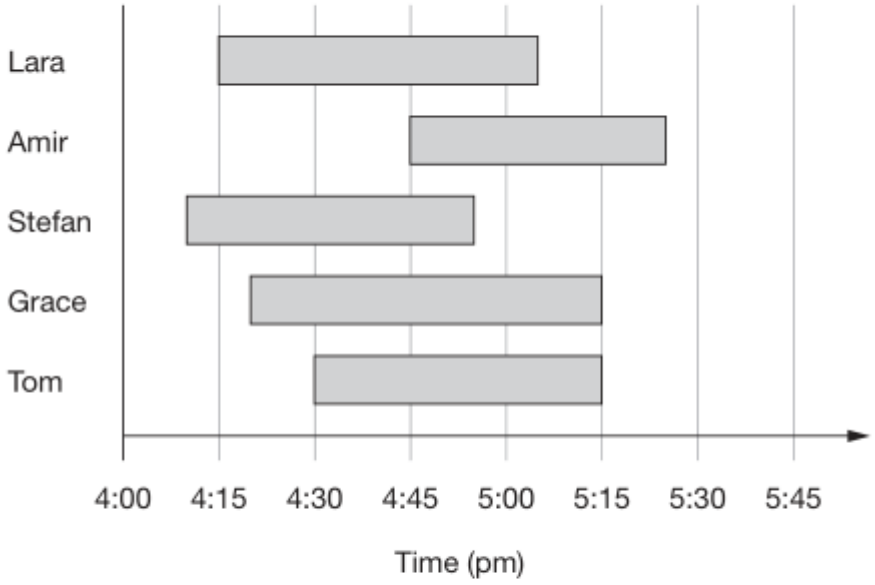
Is he correct?
Circle **Yes** or **No**.

Yes / No

Explain how you know.

MSE40

This chart shows the times when 5 children were at a swimming pool one afternoon.

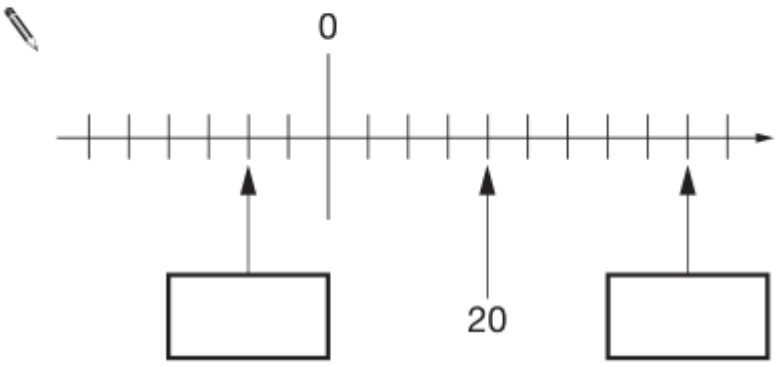


Who was the next person to arrive after Stefan?

MSE41

Here is part of a number line.

Write the missing numbers in the boxes.



MSE42

Stefan has a bag that contains 3 blue marbles and 5 red marbles only.

What fraction of the marbles in the bag are blue?

MSE43

13 Liam thinks of a number.

He divides it by 9 and then adds 25 to the result.

His answer is 36

What number did Liam start with?

Show your **method**. You may get a mark.

MSE44

$$\frac{1}{u} + \frac{1}{v} = \frac{1}{f}$$

$u = 2\frac{1}{2}$, $v = 3\frac{1}{3}$

(a) Find the value of f.

MSE45

A rugby team played 7 games.

Here is the number of points they scored in each game.

3 5 8 9 12 12 16

(a) Work out the range.

.....

(2)

MSE46

Solve the equation:

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

MSE47

Here is a list of ingredients for making **8** cheese scones.

Ingredients for 8 cheese scones
200 g self-raising flour
60 g butter
30 g cheese
150 m*l* milk

Work out the amount of each ingredient needed to make **12** cheese scones.

..... g self-raising flour

..... g butter

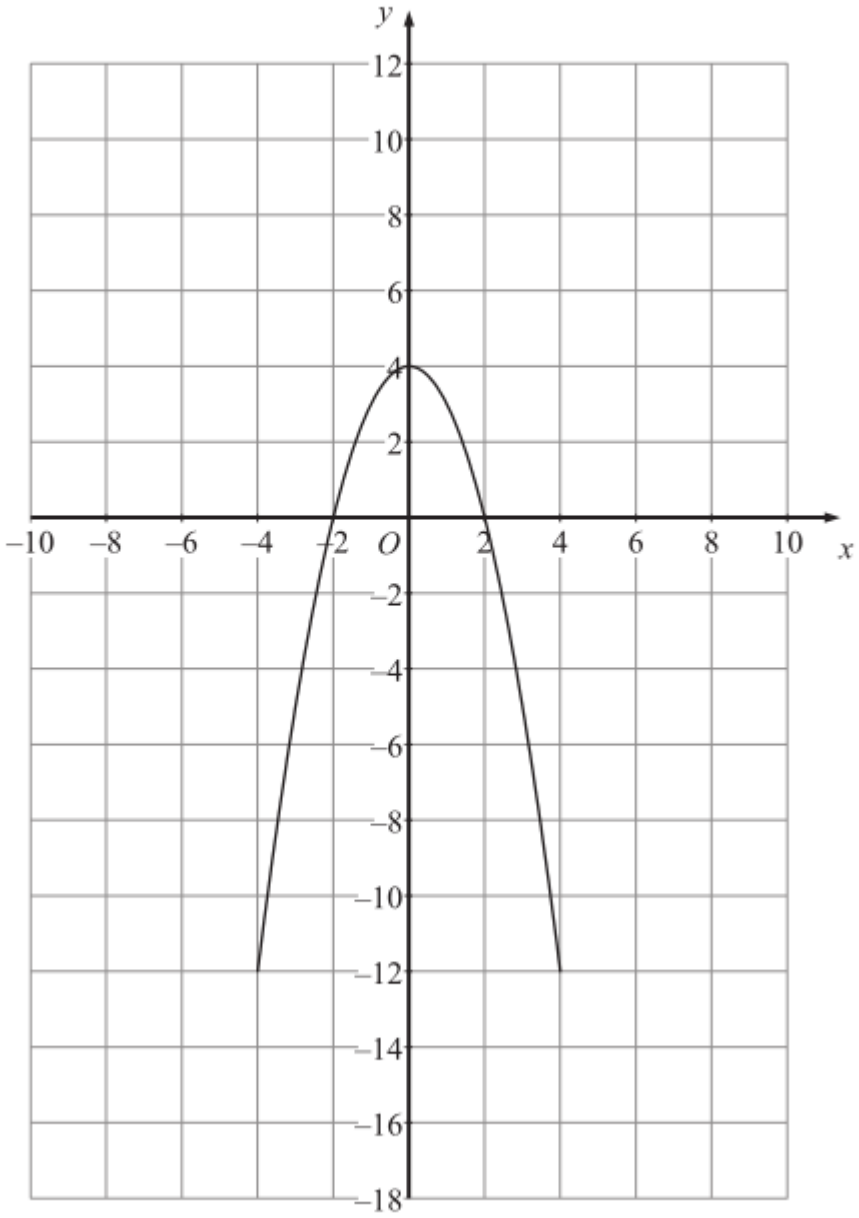
..... g cheese

..... m*l* milk

MSE48

The graph of $y = f(x)$ is shown on the grids.

(a) On this grid, sketch the graph of $y = f(x) - 4$



MSE49

Here is a picture of Fred standing outside his house.

(a) Which measurement below is most likely to be **Fred's height**?

Put a ring round the correct answer.

0.8 metres 1.8 metres 2.8 metres 3.8 metres

MSE50

Here is a picture of Fred standing outside his house.

(b) Which measurement below is most likely to be the **height** of **Fred's house**?

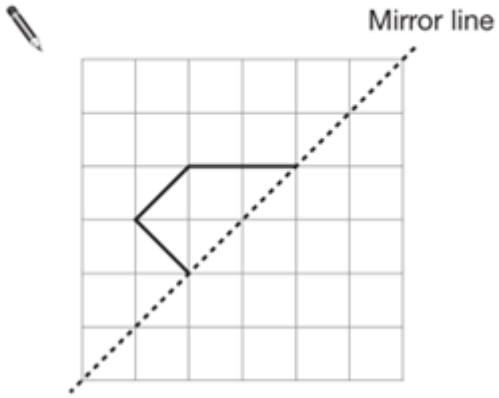
Put a ring round the correct answer.

1 metre 7 metres 17 metres 27 metres

MSE51

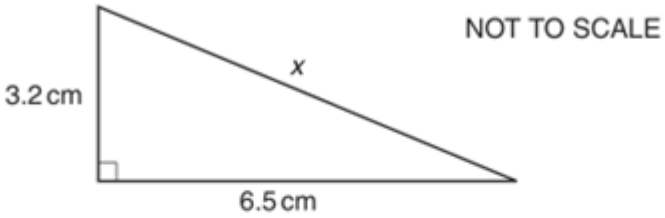
The diagrams in this question are drawn on square grids.

Reflect the shape in the mirror line.



MSE52

Calculate the value of x.



.....

.....

.....

.....

.....

.....

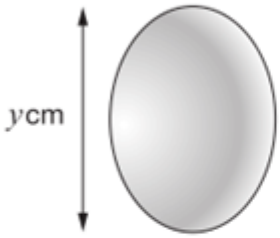
_____ cm [3]

MSE53

In this question you will need the following information about hens' eggs.

Approximate **mass**, in grams, is given by:

$$\text{Mass} = \frac{\pi y^3}{10} \times 1.15$$



Mass of egg	Grade of egg
Up to 53g	Small
53g up to 63g	Medium
63g up to 73g	Large
73g or more	Extra large

The length, y, of an egg is **5.5cm**.

Use the formula to find the **grade** of the egg.

You **must** show your working.

Grade _____

MSE54

A dessert has both fruit and yoghurt inside.

Altogether, the mass of the fruit and yoghurt is **175g**.

The **ratio** of the mass of **fruit** to the mass of **yoghurt** is **2 : 5**

What is the mass of the yoghurt?

_____ g

MSE55

Each rule below makes a sequence.

Use the rule to write the **next two numbers** for each sequence.

Rule: **Add 3** to the last number				
2	5	8	_____	_____

MSE56

Each rule below makes a sequence.

Use the rule to write the **next two numbers** for each sequence.

Rule: **Double** the last number then **add 1**				
2	5	11	_____	_____

MSE57

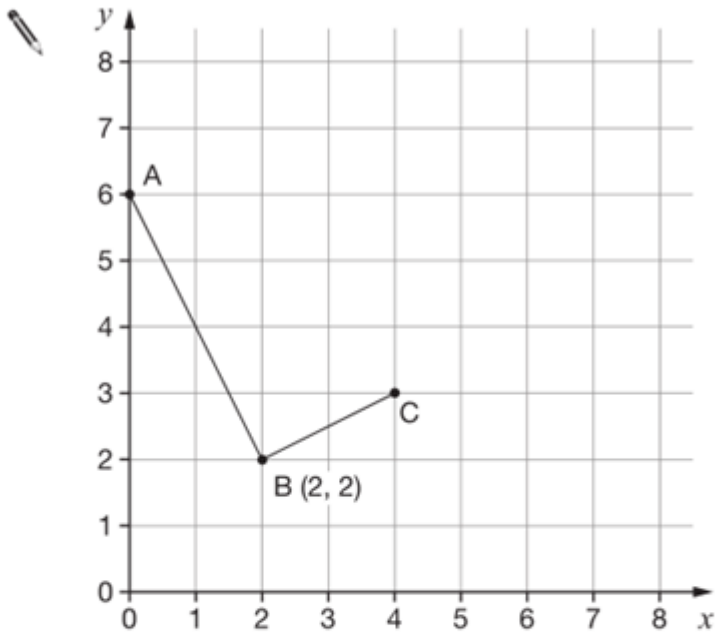
Each rule below makes a sequence.

Use the rule to write the **next two numbers** for each sequence.

Rule: **Multiply** the last number **by 3** then **subtract 1**				
2	5	14	_____	_____

MSE58

Look at the graph.



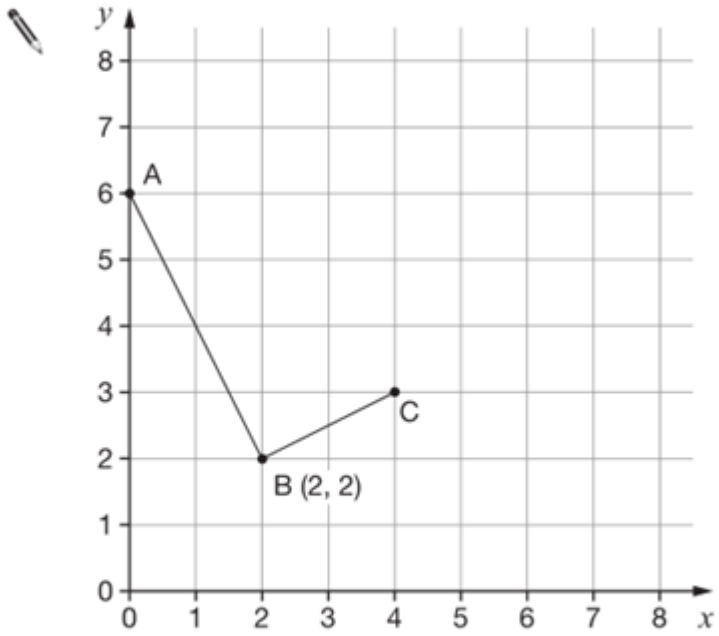
Write down the coordinates of points A and C.

A is (_____ , _____)

C is (_____ , _____)

MSE59

Look at the graph.



Point D can be marked so that ABCD is a **rectangle**.

Mark point D accurately on the graph.

MSE60

The table shows some information about five children.

Name	Gender	Age	Hair Colour
Aaron	Male	6	Black
Becky	Female	10	Brown
Kim	Female	6	Brown
Darren	Male	9	Blonde
Emily	Female	4	Red

(a) Write down the colour of Darren's hair.

.....

MSE61

The pie chart shows the sports played by 60 students during their games lesson.

(a) How many students play football?

.....

Answer .....

MSE62

Here is some information about class 7J.

There are 30 pupils altogether.
There are 2 more girls than boys.
A quarter of the girls are left-handed.
There are 7 left-handed pupils altogether.

Use this information to complete the two-way table below.

	Boys	Girls	Total
Left-handed			
Right-handed			
Total			30

MSE63

Mr. and Mrs. Jackson are going to an exhibition with their two children, Abby and Ben.
They see this price list.

Ticket type	**Cost**
Children (under 6)	free
Children (under 18)	£2.25
Adults	£5.25
Family ticket (up to 2 adults and 2 children)	£12

Abby is 6 years old and Ben is 12 years old.
Calculate how much the family saves by buying a family ticket instead of separate tickets.

£

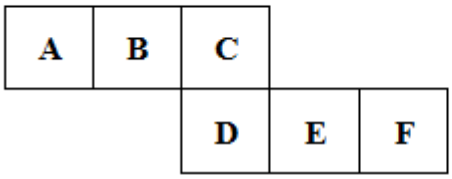
MSE64

A clock shows 12 noon.
Through how many degrees does the **hour hand** turn in an hour?

°

MSE65

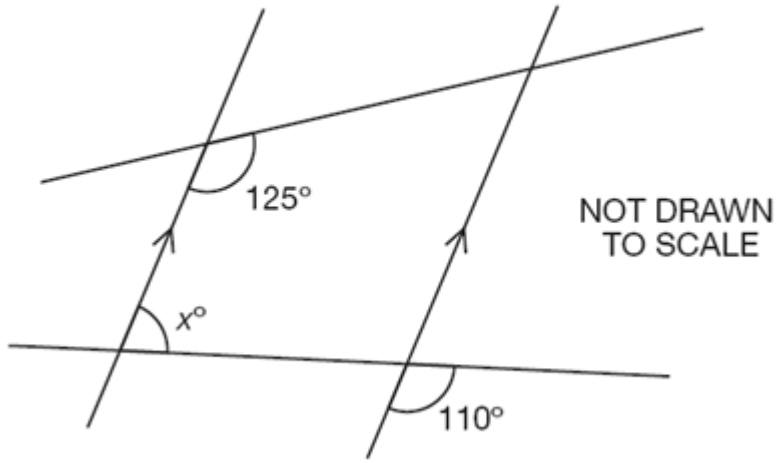
A net for making a cube is shown below.



When folded up, which face is **opposite** D?

MSE66

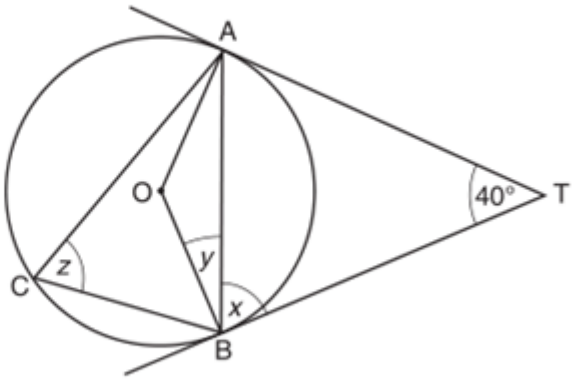
Calculate angle *x*.



MSE67

A, B and C are points on a circle, centre O.
TA and TB are tangents to the circle.
Angle ATB = 40°.

NOT TO
SCALE



(a) Find angle *x*.
Give a reason for your answer.

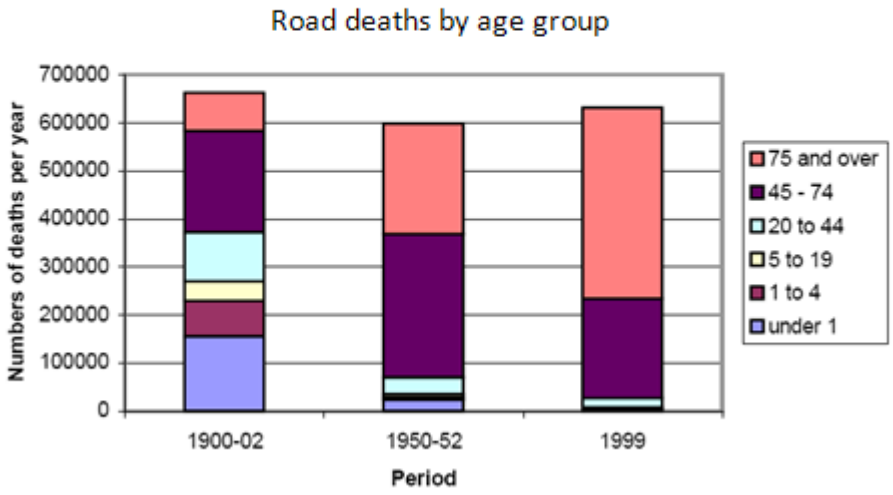
Calculate which coach journey is better value in terms of pence per mile.

Birmingham – London, 110 miles, cost £14.50
Oxford – Leeds, 170 miles, cost £24.60

MSE68

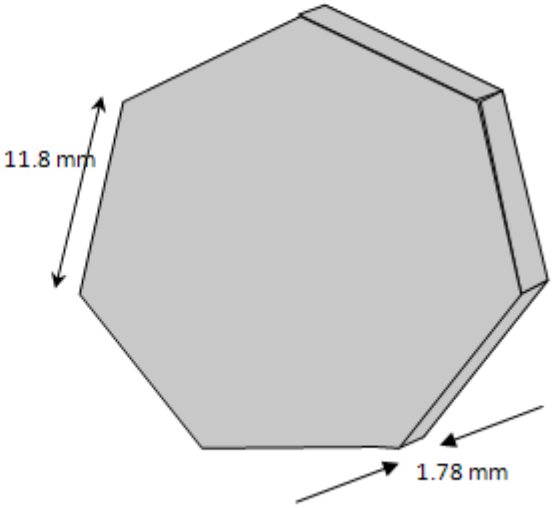
MSE69

Interpret the graph below to describe how road casualties of some different age groups have changed over time.



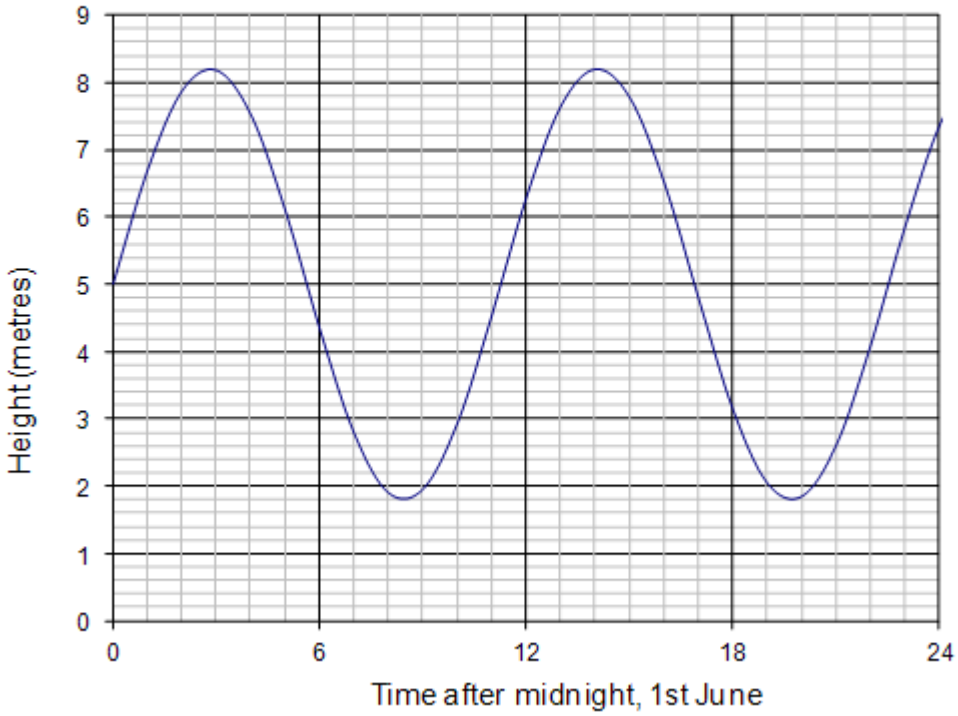
MSE70

A 50 pence piece can be modelled as a prism with a regular seven sided figure as its cross section. Using the dimensions in the diagram calculate an estimate for the volume of metal in a 50 pence piece.



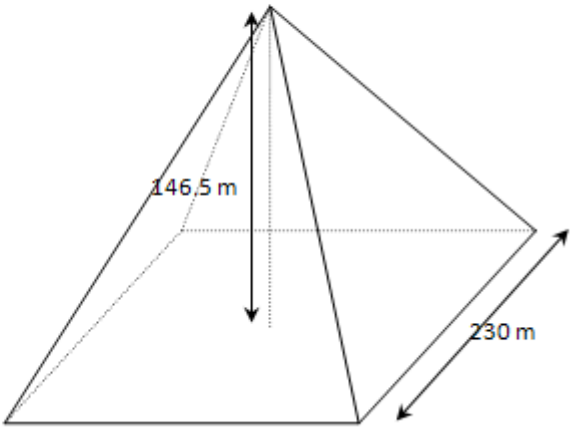
MSE71

The graph below of the height of water during one complete day at Fleetwood, on the Lancashire coast, shows that the time between high tides is not exactly twelve hours. Estimate the **times** of high and low tides one week after the day shown on this graph.



MSE72

The Great Pyramid at Giza in Egypt has dimensions as shown in the diagram. Find the angle that a triangular face makes with its (square) base.



MSE73

Assume that on average house prices rise 7% every year.
A house is valued at £V now.
By writing down a formula, in terms of V, that will allow you to estimate the future value, £$V(t)$, of a house in t years time, find the expected value of a house in 15 years time if it is valued at £175000 now.

MSE74

Use the information below to calculate the cost of a holiday for a group of six travellers. There are two couples and two single travellers in the group. They wish to start the main holiday on August 5th, with one couple and one single traveller extending the holiday for 7 nights in Sorrento in a room with a sea view and with half board.

2006 - Saturdays
per person in a twin room

Date	Price
Apr 8	£845
Apr 15	£845
Apr 22	£855
Apr 29	£855
May 6	£865
May 13	£865
May 20	£855
May 27	£855

Date	Price
Jun 3	£875
Jun 10	£875
Jun 17	£855
Jun 24	£855
Jul 1	£745
Jul 8	£745
Jul 15	£735
Jul 22	£735

Date	Price
Jul 29	£755
Aug 5	£745
Aug 12	£775
Aug 19	£775
Aug 26	£775
Sep 2	£875
Sep 9	£875
Sep 16	£865

Date	Price
Sep 23	£865
Sep 30	£865
Oct 7	£875
Oct 14	£855
Oct 21	£845

Price Includes
Air travel, UK departure taxes, overseas airport taxes, all transportation, breakfast daily, dinner on days 4 & 7, itinerary as described, tour escort and official city guides, guidebook
Not Included

Supplements per person	
Supplement	Price
Single supplement	£170

Extension	
7-nights Sorrento	Price
Grand Hotel Vesuvio	£375
(Aug - Oct)	£425
Single supplement	£70
Sea view	£75
Half board (lunch or dinner)	£50
Sea view	£75

MSE75

The table gives the lengths of rivers in metres but expressed in different ways.
Put these rivers in decreasing order of length.

River	Length
Amazon	6.39×10^6 metres
Yellow	4.67×10^9 millimetres
Nile	6690000000 millimetres
Yangtze	6380 kilometres
Congo	4371000 metres
Mississippi	6.27×10^6 kilometres

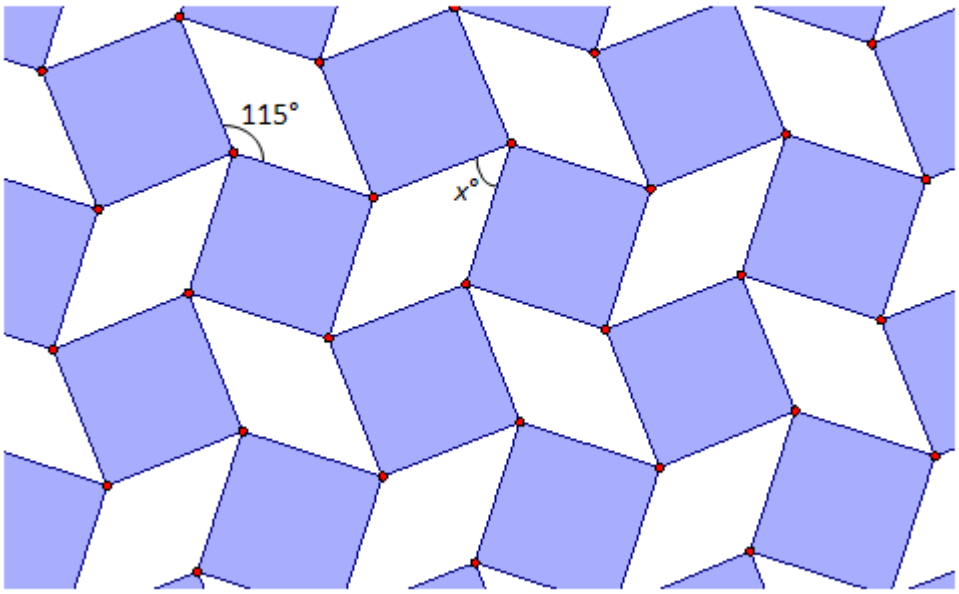
MSE76

Solve for x:

$15 - 2x = 3x + 25$

MSE77

The diagram shows a tiling pattern formed by tessellating squares and parallelograms.
Find the angle marked $x°$.



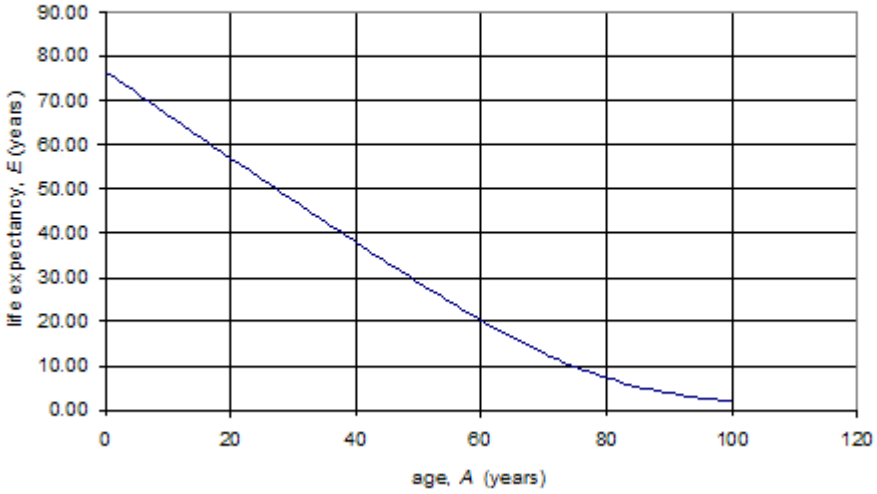
MSE78

A golfer hits a ball so that its height, h metres, above horizontal ground is given by $h = 20t - 5t^2$.

Find when the ball is 5 metres above the ground by solving $5 = 20t - 5t^2$.

MSE79

The graph below shows how male life expectancy, E years, varies with age, A years.
Find a linear formula connecting E and A for males aged between 0 and 60 years.



APPENDIX 3 – MSE ITEMS BY DATA POINT AND YEAR GROUP

There were the occasional small differences between online and hard copy items and the items were also presented in slightly different orders to:

1. manage efficient use of space in the hard copies between long and short items and to
2. make it easier for the online survey to manage the different routes through the MSE items (depending on year group)

Items given at each year group, at **DP1**:

item	Y7	Y8	Y9	Y10	Y11
MSE11	x				
MSE17	x	x			
MSE38	x				
MSE42	x				
MSE33	x				
MSE21	x				
MSE27	x	x			
MSE31	x				
MSE41	x				
MSE51	x	x	x		
MSE2	x				
MSE60	x	x			
MSE40	x	x			
MSE37	x	x	x		
MSE26	x	x	x		
MSE62	x	x			
MSE49	x	x	x		
MSE50				x	x
MSE55	x				
MSE56		x			
MSE57			x		
MSE30		x	x		
MSE63		x	x	x	
MSE39		x	x	x	x
MSE1		x			
MSE45	x	x	x	x	x
MSE13		x	x	x	x
MSE19		x	x		
MSE34	x				
MSE35		x	x		
MSE36				x	x
MSE47		x	x	x	x
MSE58		x	x	x	

item	Y7	Y8	Y9	Y10	Y11
MSE59		x		x	
MSE4		x	x		
MSE10			x	x	
MSE16			x	x	
MSE32			x	x	
MSE23			x	x	x
MSE61				x	x
MSE3				x	x
MSE20				x	x
MSE25				x	x
MSE53				x	x
MSE48				x	x
MSE66				x	
MSE18				x	
MSE67					x
MSE24					x
MSE43					x
MSE52					x
MSE44					x
MSE74					x
MSE75					x
MSE76				x	x
MSE69				x	x

Items given at each year group, at **DP2**:

item	Y7	Y8	Y9	Y10	Y11
MSE38	x				
MSE30	x				
MSE42	x				
MSE31	x				
MSE2	x				
MSE27	x	x			
MSE21	x	x	x		
MSE13	x	x	x	x	
MSE45	x	x	x	x	
MSE26	x	x	x		
MSE12	x	x	x		
MSE17	x	x			
MSE40	x	x			
MSE49	x	x			
MSE35	x	x			
MSE60	x	x			
MSE51	x	x	x		

item	Y7	Y8	Y9	Y10	Y11
MSE33	x	x	x	x	
MSE64	x	x	x	x	
MSE4	x	x	x	x	
MSE23	x	x	x	x	x
MSE47				x	x
MSE61				x	
MSE19		x			
MSE29		x	x		
MSE63		x	x	x	
MSE39		x	x	x	
MSE58		x	x	x	
MSE10			x	x	
MSE36			x	x	x
MSE20			x	x	x
MSE76			x	x	x
MSE25			x	x	x
MSE3		x	x	x	x
MSE54		x	x	x	
MSE65		x	x	x	
MSE5		x	x	x	
MSE22		x	x	x	
MSE66			x	x	
MSE53			x	x	x
MSE69				x	x
MSE48				x	x
MSE44				x	x
MSE50					x
MSE67					x
MSE24					x
MSE43					x
MSE75					x
MSE77					x
MSE78					x
MSE72					x
MSE6					x
MSE7					x
MSE8					x
MSE9					x
MSE15					x
MSE14					x

Items given at each year group, at **DP3**:

item	Y7	Y8	Y9	Y10	Y11	Y12
MSE11	x					
MSE38	x					
MSE42	x					
MSE33	x					
MSE21	x					
MSE31	x					
MSE41	x					
MSE2	x					
MSE17	x	x				
MSE27	x	x				
MSE60	x	x				
MSE40	x	x				
MSE62	x	x				
MSE51	x	x	x			
MSE37	x	x	x			
MSE26	x	x	x			
MSE49	x	x	x			
MSE1		x				
MSE56		x				
MSE50				x	x	
MSE57			x			
MSE30	x	x	x			
MSE63		x	x	x		
MSE39		x	x	x	x	
MSE45	x	x	x	x	x	x
MSE13		x	x	x	x	x
MSE47		x	x	x	x	
MSE58		x	x	x		
MSE19		x	x			
MSE35		x	x			
MSE4		x	x			
MSE55	x					
MSE34	x					
MSE10			x	x		
MSE16			x	x		
MSE32			x	x		
MSE23			x	x	x	x
MSE46			x	x	x	x
MSE3			x	x	x	x
MSE36				x	x	x
MSE61				x	x	x
MSE20				x	x	x
MSE25				x	x	x

item	Y7	Y8	Y9	Y10	Y11	Y12
MSE53				x	x	x
MSE66				x		
MSE18				x		
MSE48					x	
MSE67					x	
MSE24					x	
MSE43					x	
MSE52					x	
MSE44					x	
MSE74					x	x
MSE75					x	x
MSE76				x	x	x
MSE69				x	x	x
MSE77						x
MSE78						x
MSE72						x
MSE68						x
MSE79						x
MSE70						x
MSE71						x
MSE73						x

APPENDIX 4 – EXAMPLE OF MEASURE CONSTRUCTION FOR "PARENTAL INVOLVEMENT/SUPPORT"

As described above the starting ingredient in the process of measure construction is the questions. For the case of 'parental involvement/support', the items as appeared in the questionnaire (with some labels shown in red), are shown below:

How often do your parents/carers do the following?
(Please circle the most appropriate number in each line)

	Never	Rarely	Sometimes	Often	All the time
Check whether you have done your homework [parents1]	1	2	3	4	5
Help you with your homework [parents2]	1	2	3	4	5
Praise or reward you for good grades [parents3]	1	2	3	4	5
Reduce your rewards because of low grades [parents4]	1	2	3	4	5
Find you a tutor to help you with your homework [parents5]	1	2	3	4	5

We hypothesise that these items form together an underlying construct of 'students perception of parental involvement' and we use the tools provided by the Rasch analysis to create and validate this measure (and others). Another necessary ingredient to perform this analysis/validation is the students' responses to these questions which are denoted by the values 1 to 5, as shown above: the higher the score the more frequent each practice.

The ultimate outcome, if measurement is deemed valid, would be a score for each student on a logit scale, which can be used for further analysis. Our decisions about the validity of the measures are based on the following statistical indices, with the example results shown here:

Item fit statistics

Fit statistics (i.e. Infit and Outfit mean-squares, MNSQ) are used in the Rasch context to check fulfilment of unidimensionality assumption and to flag items that may be problematic in this respect. In a 'perfect' measure these statistics should be 1, but an acceptable range is within 0.6 to 1.4 depending on the analysis. For most of our analyses we take the value of 1.4 as a value for infit and outfit mean squares that suggests causes for concern, and we explore those more.

ENTRY NUMBER	TOTAL SCORE	TOTAL COUNT	MEASURE	MODEL S.E.	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD	PT-MEASURE CORR.	PT-MEASURE EXP.	EXACT MATCH OBS%	EXACT MATCH EXP%	ITEM
1	110814	30607	-.96	.01	.94	-7.4	.94	-7.6	.66	.63	40.8	39.7	parents1
2	89608	30548	-.20	.01	.72	-9.9	.76	-9.9	.66	.63	45.0	36.3	parents2
3	107576	30449	-.86	.01	1.00	-.4	1.00	-.4	.63	.63	39.1	39.7	parents3
4	64953	30388	.68	.01	1.16	9.9	1.19	9.9	.58	.61	38.9	39.1	parents4
5	51165	30429	1.34	.01	1.38	9.9	1.36	9.9	.53	.57	49.2	52.3	parents5
MEAN	84823.2	30484	.00	.01	1.04	.4	1.05	.4			42.6	41.4	
S.D.	23425.6	80.9	.89	.00	.22	8.3	.21	8.4			3.9	5.6	

Table A1 - Item statistics output from Winsteps

As shown in Table A1, there are no threats for this aspect of validity since all items appear within acceptable ranges.

Category Statistics

Rating scales and their response formats serve as tools with which the researcher communicates with the respondents, a function defined by Lopez (1996) as 'communication validity'. Examining category statistics is essential within the Rasch measurement framework in order to confirm the appropriateness of the Likert scale used and its interpretation by the respondents. A well-functioning scale should, at least, present ordered average measures, and ordered step calibrations (Linacre, 2002) with acceptable fit statistics, as shown here (see Table A2 and/or Figure A1). In the probability plot of Figure 2, the four thresholds (i.e. boundary between category 1 and 2, 2 and 3, 3 and 4, 4 and 5) are denoted with arrows superimposed on the probability curves of each category. Most of those seem to be ordered, however there is a small overlap between the first two boundaries, probably because of the ambiguity of response categories "rarely" and "sometimes". An improved measure could be calculated by collapsing these two options (which also provides suggestions for improving the questionnaire).

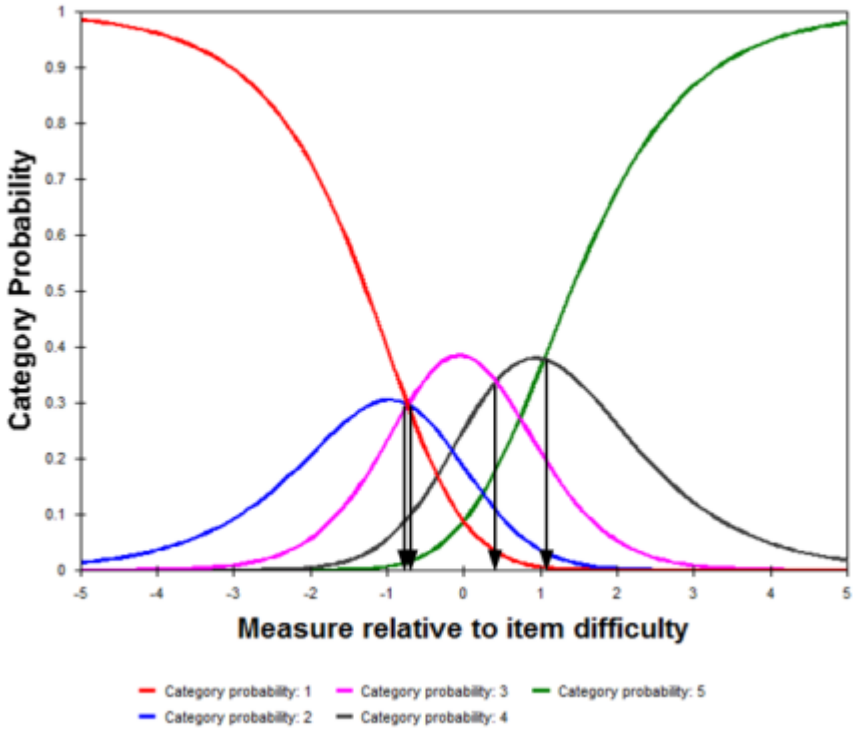


Figure A1 - Category probability against item difficulty

SUMMARY OF CATEGORY STRUCTURE. Model="R"

CATEGORY LABEL	SCORE	OBSERVED COUNT	%	OBSVD AVRGE	SAMPLE EXPECT	INFIT MNSQ	OUTFIT MNSQ	STRUCTURE CALIBRATN	CATEGORY MEASURE	
1	1	41053	27	-1.57	-1.54	.93	.96	NONE	(-2.27)	1
2	2	25626	17	-.71	-.78	1.00	.94	-.74	-.97	2
3	3	34437	23	-.09	-.10	.94	.95	-.73	-.06	3
4	4	28025	18	.52	.51	1.01	1.13	.42	.93	4
5	5	23280	15	1.07	1.10	1.15	1.29	1.04	(2.43)	5
MISSING		835	1	-.51						

OBSERVED AVERAGE is mean of measures in category. It is not a parameter estimate.

Table A2 - Category statistics output from Winsteps

Person - item maps and the item difficulty hierarchy

Figure A2 shows the resulting measurement scale of students' scores and items' "difficulties". At the left end of the figure the logit scale is shown (with the numbers ranging from -3 to 4); this is the common measurement scale for both items and persons (i.e. students). On the right hand side of the students' 'histogram' the items that constitute the scale are presented, ranging from the easiest to report agreement with (bottom) to the most difficult. The description of the items that correspond to each code can be seen above. At the left side of the map the students' distribution in the scale is. The higher the place of a student in that scale the more parental support/involvement they perceive they receive.

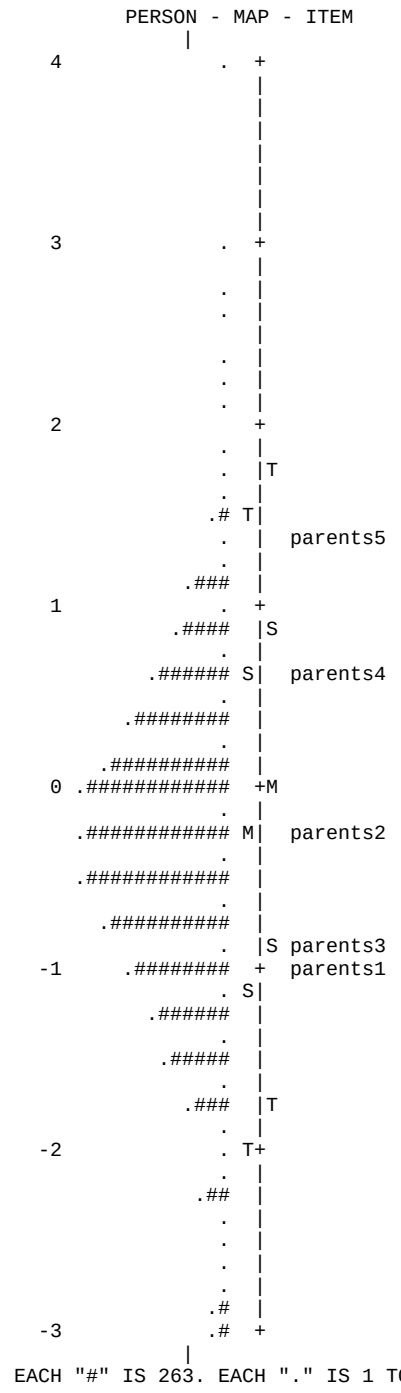


Figure A2 - Item map output from Winsteps

APPENDIX 5 – SUMMARY OF ACCORN TYPES

	Acorn Group	ACORN TYPE	Acorn Type 2
1. Affluent Achievers			
A	Lavish Lifestyles	1	Exclusive enclaves
		2	Metropolitan money
		3	Large house luxury
B	Executive Wealth	4	Asset rich families
		5	Wealthy countryside commuters
		6	Financially comfortable families
		7	Affluent professionals
		8	Prosperous suburban families
		9	Well-off edge of towners
C	Mature Money	10	Better-off villagers
		11	Settled suburbia, older people
		12	Retired and empty nesters
		13	Upmarket downsizers
2. Rising Prosperity			
D	City Sophisticates	14	Townhouse cosmopolitans
		15	Younger professionals in smaller flats
		16	Metropolitan professionals
		17	Socialising young renters
E	Career Climbers	18	Career driven young families
		19	First time buyers in small, modern homes
		20	Mixed metropolitan areas
3. Comfortable Communities			
F	Countryside Communities	21	Farms and cottages
		22	Larger families in rural areas
		23	Owner occupiers in small towns and villages
G	Successful Suburbs	24	Comfortably-off families in modern housing
		25	Larger family homes, multi-ethnic areas
		26	Semi-professional families, owner occupied neighbourhoods
H	Steady Neighbourhoods	27	Suburban semis, conventional attitudes
		28	Owner occupied terraces, average income
		29	Established suburbs, older families
I	Comfortable Seniors	30	Older people, neat and tidy neighbourhoods
		31	Elderly singles in purpose-built accommodation
J	Starting Out	32	Educated families in terraces, young children
		33	Smaller houses and starter homes

4. Financially Stretched			
K	Student Life	34	Student flats and halls of residence
		35	Term-time terraces
		36	Educated young people in flats and tenements
L	Modest Means	37	Low cost flats in suburban areas
		38	Semi-skilled workers in traditional neighbourhoods
		39	Fading owner occupied terraces
		40	High occupancy terraces, many Asian families
M	Striving Families	41	Labouring semi-rural estates
		42	Struggling young families in post-war terraces
		43	Families in right-to-buy estates
		44	Post-war estates, limited means
N	Poorer Pensioners	45	Pensioners in social housing, semis and terraces
		46	Elderly people in social rented flats
		47	Low income older people in smaller semis
		48	Pensioners and singles in social rented flats
5. Urban Adversity			
O	Young Hardship	49	Young families in low cost private flats
		50	Struggling younger people in mixed tenure
		51	Young people in small, low cost terraces
P	Struggling Estates	52	Poorer families, many children, terraced housing
		53	Low income terraces
		54	Multi-ethnic, purpose-built estates
		55	Deprived and ethnically diverse in flats
		56	Low income large families in social rented semis
Q	Difficult Circumstances	57	Social rented flats, families and single parents
		58	Singles and young families, some receiving benefits
		59	Deprived areas and high-rise flats
6. Not Private Households			
R	Not Private Households	60	Active communal population
		61	Inactive communal population
		62	Business addresses without resident population