3748-120 (Evolve) and 3748-320 (Paper-based)

Functional Skills Mathematics Level 2

Guidance for Delivery

About City & Guilds

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Contents

1. Structure of the assessment

The test specification requires candidates to demonstrate their competence (functionality) in mathematics at the appropriate level.

Assessment covers the three areas of the qualification specification, ie **represent**, **analyse**, and **interpret**. Equal weighting (approximately) is given to each area.

Represent:
find information / data
needed to solve problem,
decide methods

30-40%

Analyse:
calculate, check

30-40%

Interpret:
present and explain
results, review task

30-40%
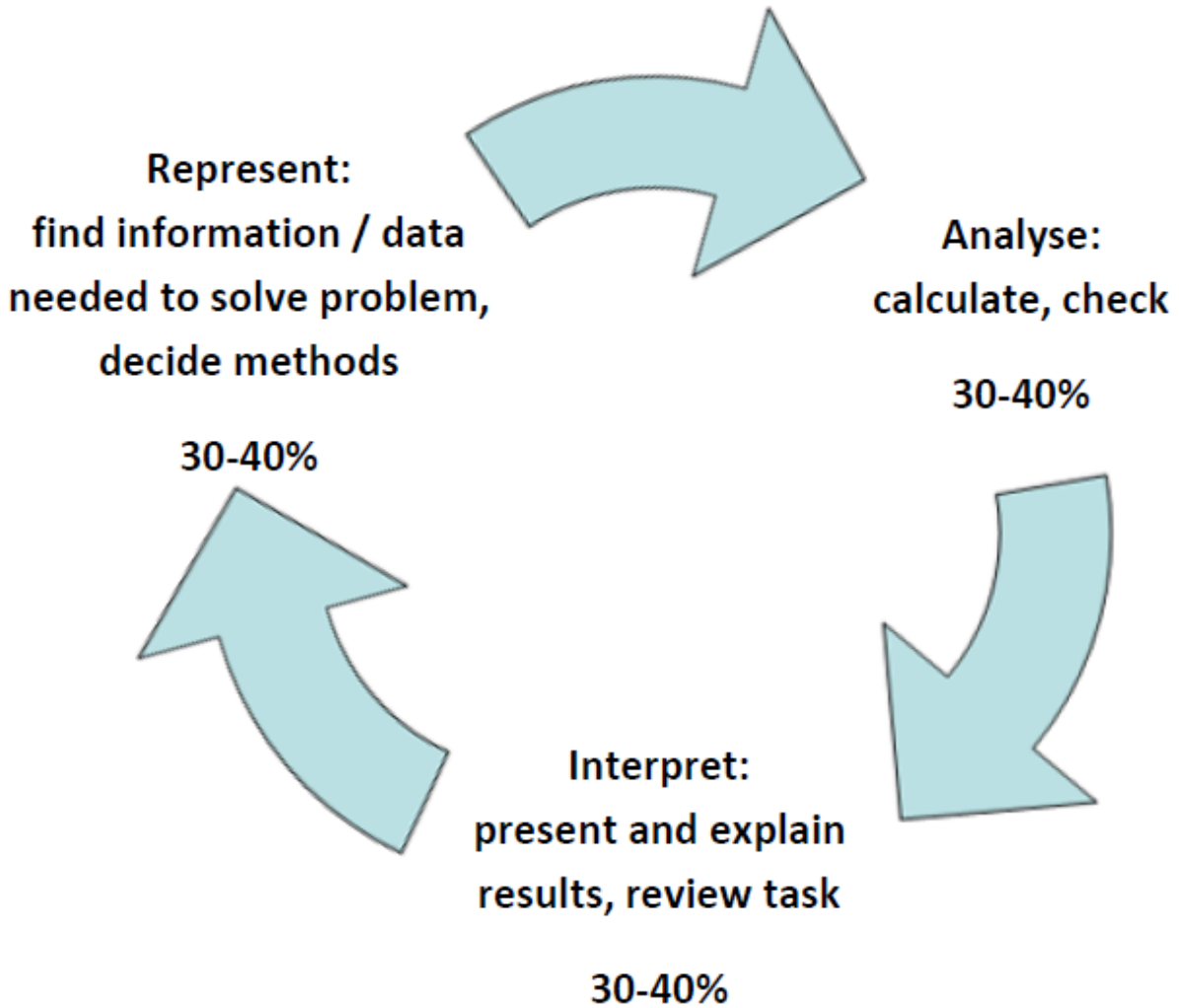
The assessments are generic rather than vocationally based. Content of the specification broadly fits the adult numeracy core curriculum (found [here](#)).

Functional Mathematics papers comprise three holistic tasks, each covering one area of technical content and skills within the following areas: number; shape, space and measure; and handling data / statistics. All the task also cover the three process skills: **represent**, **analyse** and **interpret**.

PROCESS

Represent =
plan; find information needed; decide methods

Analyse =
do calculations and check them

Interpret =
present and explain the results; review task

TASK 1
Number
eg money, time

TASK 2
Shape, space and measures
eg scaling

TASK 3
Statistics
eg averages, range, probability, trends
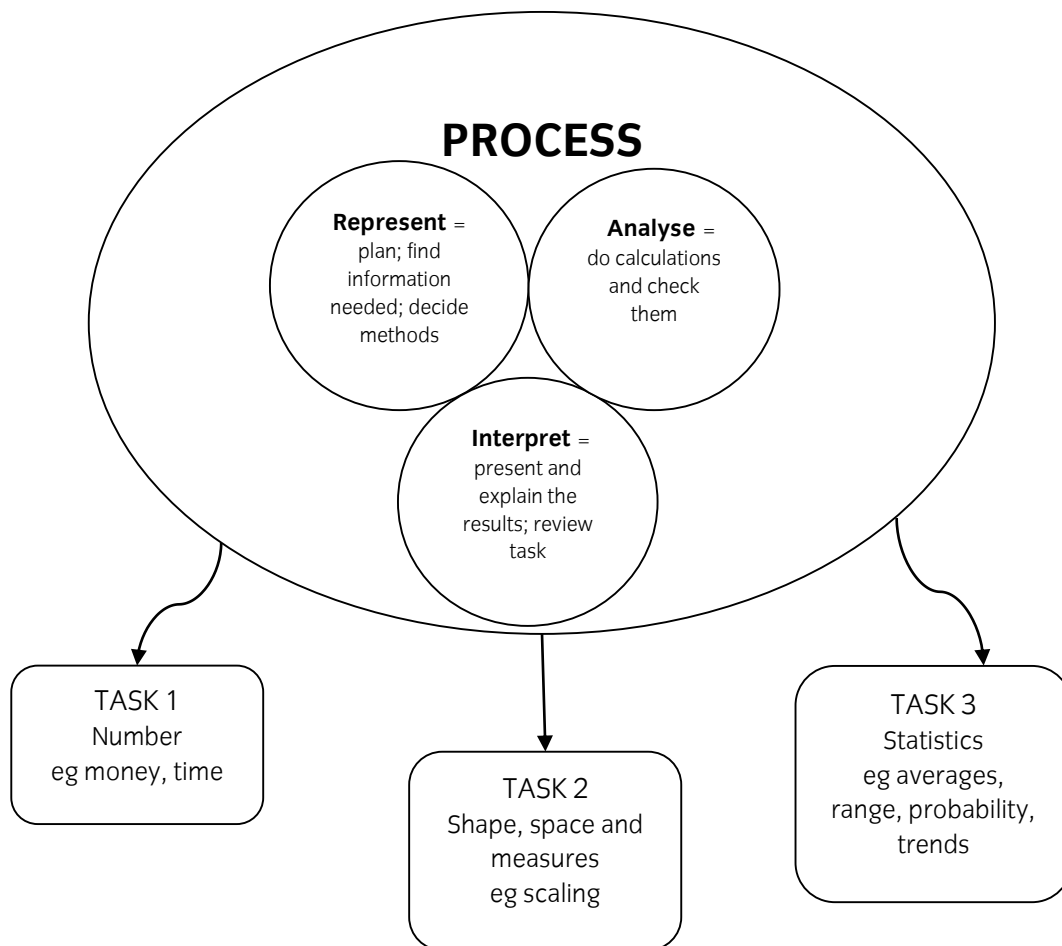
There are two options for assessment:
- an onscreen test (E-volve)
- a paper-based test.

Both options are on demand.

2. General

Centres should be aware that the Functional Skills Mathematics specification must be read in conjunction with the Adult Numeracy standards at level 2 (found here). The assessment test is based in the context of this specification and teaching should reflect the specification contents.

Regardless of which assessment option is chosen, candidates should be familiar with sample papers, which are indicative of content. Both onscreen (E-volve) and paper-based samples will assist this process. Samples of both types are available on the City and Guilds website. It is also important that candidates are aware of the format of the option they have chosen.

E-volve candidates should be given the opportunity to practise online samples. They should be aware that answers must be recorded in the answer boxes where provided and working should be shown in the space provided for working. Candidates who fail to do these things will be unable to access compensation marks if their final answer is incorrect. Candidates should practise presentation skills using the navigation tool found here. Practise with options 1 (calculator and work box), 4 (probability), 5 (table), 8 - 11 (charts and graphs) will be of particular value to Level 2 candidates.

Level 2 candidates will **not** be required to draw scale diagrams, but they should be familiar with using lines and marking positions with given symbols, eg a cross. Note the calculator tool does not save candidate workings. Candidates must show their workings in the space provided for working.

Candidates opting for paper-based assessment should also be given the opportunity to practise sample papers. They must also answer in spaces provided and are advised to show working. They must have rulers, calculators and protractors in order to successfully attempt some of the tasks. Level 2 candidates will not be required to draw scale diagrams in the paper-based assessment.

Some candidates lose marks by not reading all of the instructions carefully, including the introduction to the task. The tasks are holistic in nature and it is important that candidates grasp the overall problem set and follow instructions carefully.

3. Represent (finding information, methodology)

Functional Skills assessment is not simply about doing calculations. It is also concerned with testing the ability of a candidate to make choices about the data required to solve a task, about planning an approach and deciding which method(s) to use.

3.1 Finding information
Information will be found in the introduction to a task, the text in the question itself, in table format and in a variety of other presentations, including timetables, 'advertisements', diagrams, simple maps, sketches, line graphs, scatter graphs and charts. Some candidates do not properly assess this data, which may contain both information required for a task and other information that is not specifically required. These candidates need practice in the problem solving aspect of the assessment, ie, relating the objectives of a task to the data supplied and discerning what data is and is not relevant.

Some candidates have particular difficulties in extracting information from timetables, confusing times of departure and arrival. Scale diagrams are sometimes misinterpreted, often because there is no understanding of the scale used.

Misunderstanding units; particularly relating to linear dimensions (mm, cm, m and km) and time, prevents some candidates from successfully completing their search for information needed to complete a task.

Examples of data presentation

Table

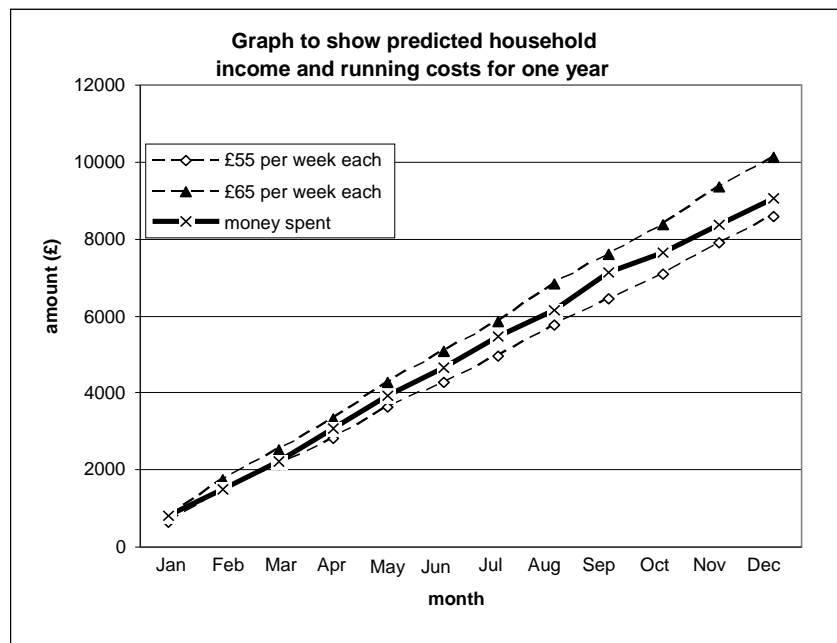| Total hours of sunshine in June		
	Sunshine (hours)	
Year	Site A	Site B
1991	135.0	153.8
1992	213.7	192.7
1993	224.2	193.6
1994	265.0	198.8
1995	187.7	182.9
1996	282.7	244.5
1997	151.6	136.5
1998	158.4	141.7
1999	239.1	188.5
2000	169.5	151.9
2001	248.0	160.0
2002	191.5	197.3
2003	245.5	215.1
2004	236.0	194.5
2005	219.3	194.9
2006	263.3	171.7
2007	170.7	154.5
2008	226.9	198.1
2009	192.8	184.9
2010	219.1	220.1
Total	**4240.0**	**3676.0**

Note that some information may not be required. Candidates are expected to select the information they need. In this example, candidates need to select relevant data for average and range.

Bar chart

Total rainfall for June 1991-2010
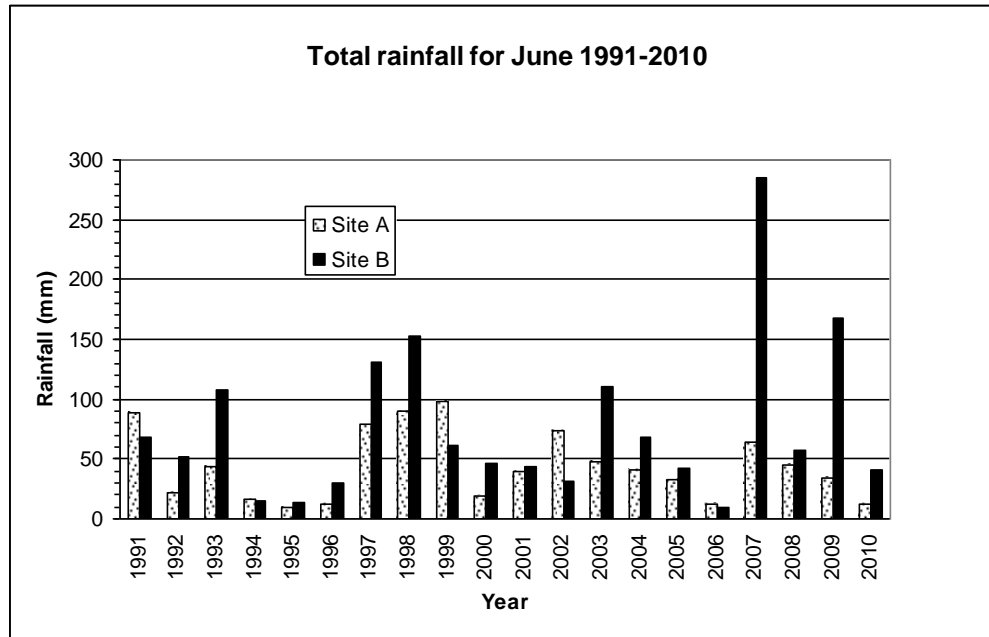
In this example, candidates are expected to compare rainfall for the two sites.

Multi-line graph

Graph to show predicted household income and running costs for one year

In this example, candidates should recognise that a £55 contribution is insufficient to cover money spent whereas a £65 contribution will cover expenditure.

Map
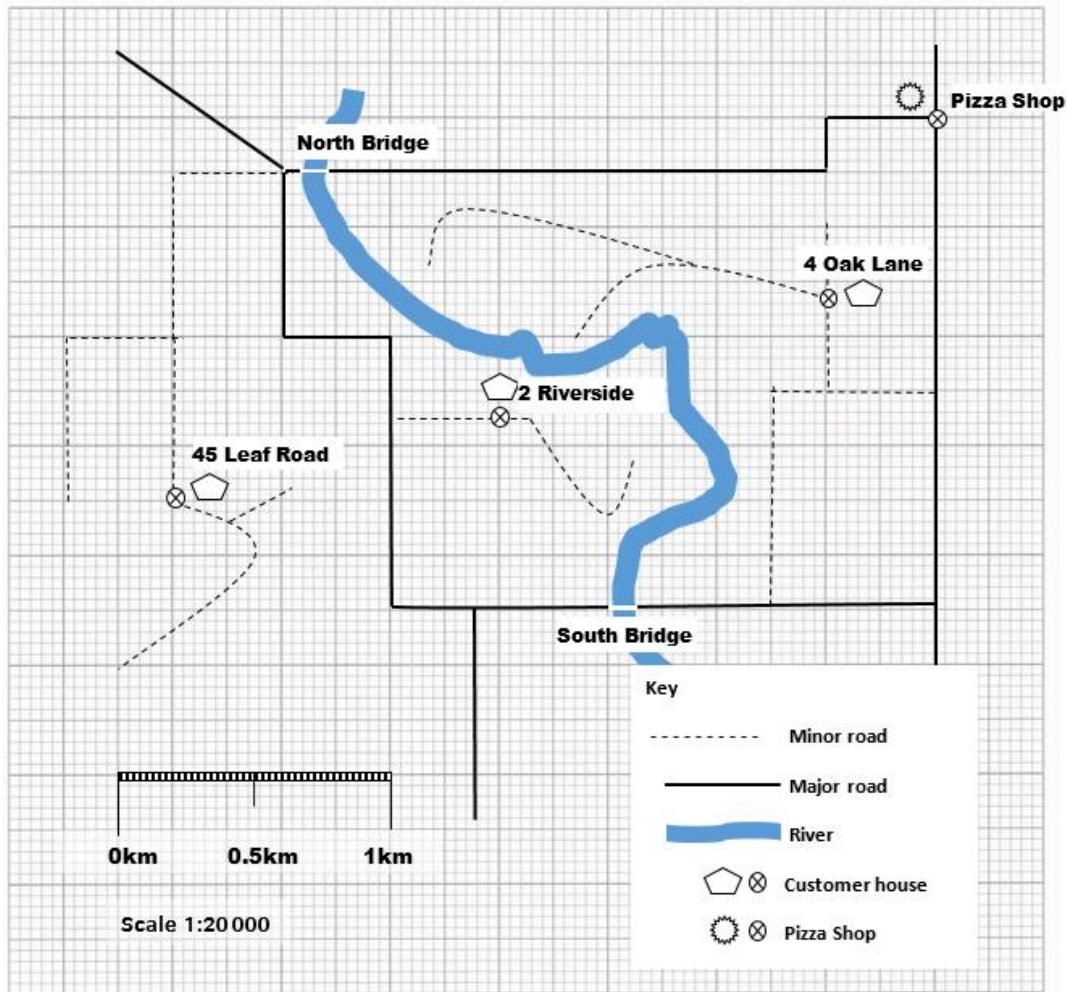
In this example, candidates might be required to work out distances from the scale given. Candidates using the E-volve option are required to interpret distances using the grid as a means of measuring distances. The grid used is standard 2mm graph paper and candidates can interpret the given grid in terms of 1cm = 1 square (ie 2mm = 1 small square), although they are unable to directly take measurements on screen.

Candidates using the paper based option need a ruler to measure distances on maps and scale diagrams.

Allowance is made in mark schemes for sensible approximations where lines are not straight. Allowance is also made for the slightly different start and end points of any measurements made. Candidates must use the scale given to calculate actual distances.

Diagram (scaled)
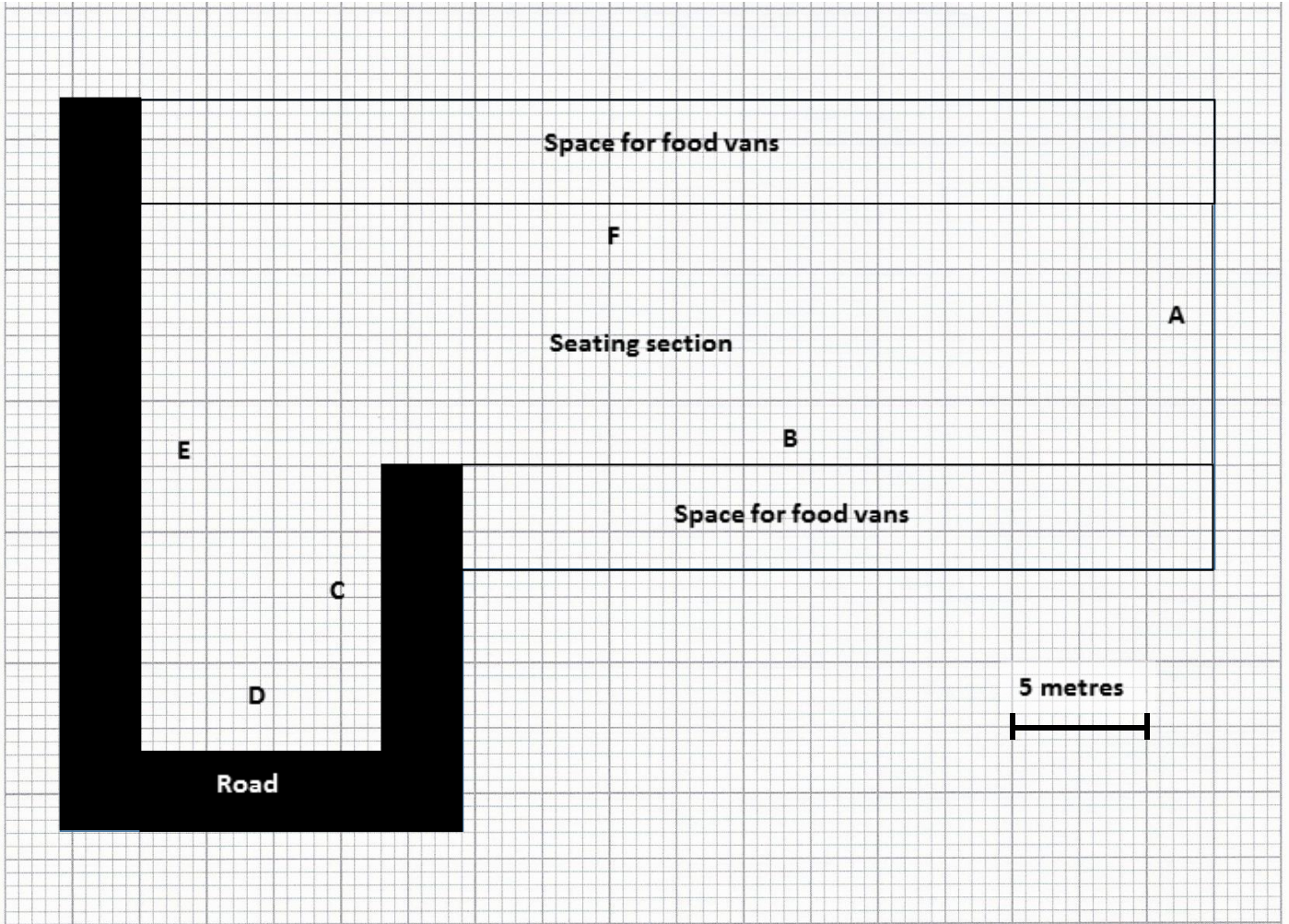
In this example, candidates might be required to calculate dimensions from the given scale.

Diagram (unscaled)
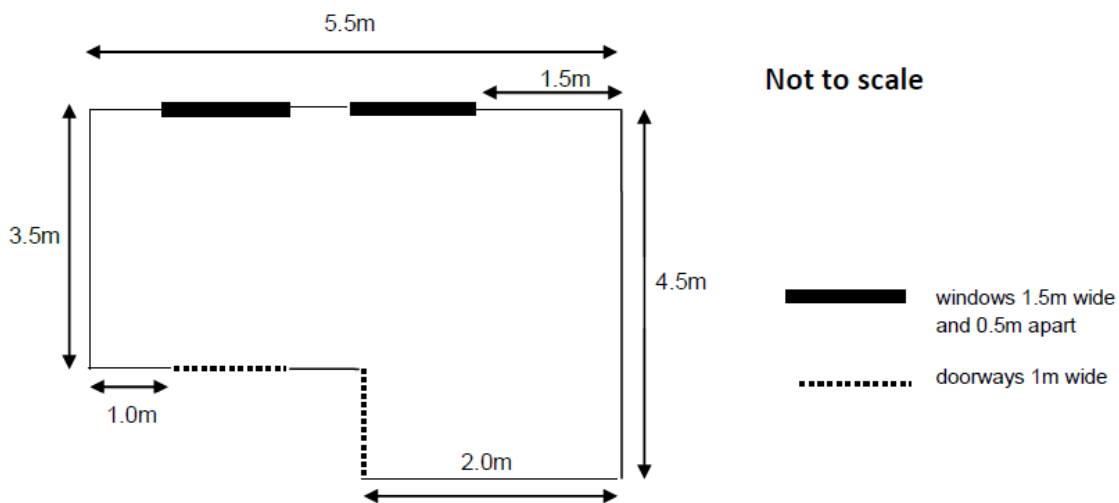
In this example, candidates might be required to calculate area from the dimensions given.

Train timetable

Middlesbrough – Stockton – Newcastle								
Middlesbrough	1032	1132	1232	1332	1432	1532	1632	1732
Stockton	1043	1143	1243	1343	1443	1543	1644	1743
Billingham	1050	1150	1250	1350	1450	1550	1651	1750
Hartlepool	1102	1202	1302	1402	1502	1602	1703	1802
Sunderland	1128	1229	1328	1428	1528	1627	1729	1828
Newcastle	1152	1251	1351	1451	1551	1651	1751	1853
Newcastle – Stockton – Middlesbrough								
Newcastle	1230	1330	1430	1530	1630	1730	1830	1930
Sunderland	1250	1349	1449	1549	1649	1749	1849	1949
Hartlepool	1315	1415	1515	1615	1715	1815	1915	2015
Billingham	1326	1426	1526	1626	1726	1826	1926	2026
Stockton	1333	1433	1533	1633	1733	1833	1933	2033
Middlesbrough	1348	1448	1548	1647	1749	1848	1948	2050

In this example, candidates might be required to plan a journey based on a criteria.

Some candidates have difficulty understanding
- the relevance or not of interim stations
- return journeys
- time taken.

Scatter graph and trend line (line of best fit)
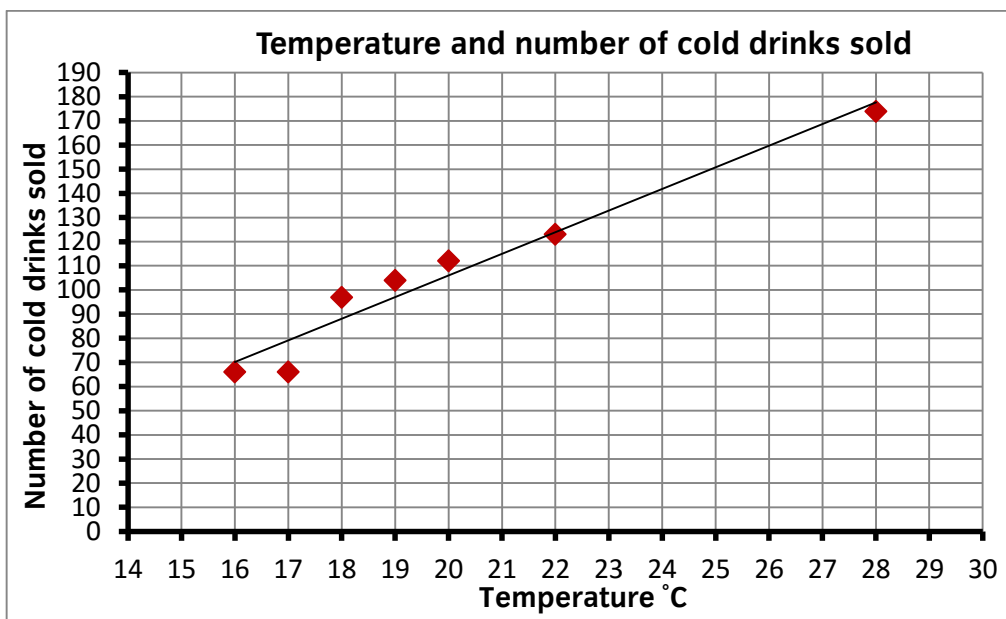
Candidates should be able to extract information from the graph and understand that the trend line (line of best fit) shows that the number of cold drinks sold tends to be greater when the temperature is higher.

4. Analyse (calculating and checking)

4.1 General

Many candidates do not show units either in their answers or workings. Although a candidate will not be repeatedly penalised for this, the absence of units can lead to confusion for the candidate as their answer develops. Many candidates ignore the need to make use of the £ sign and some give answers in incorrect money format **eg** an answer £35.10 written as £35.1 will be penalised.

The misreading or misinterpretation of answers from calculators causes problems for a number of candidates. This particularly applies to the position of the decimal point leading in certain cases to clearly inappropriate solutions.

Understanding the sensible use of rounding is problematic for some candidates. As a general rule, candidates should not round values when doing calculations leading to a final answer, ie premature rounding may lead to an inaccurate final answer.

Candidates must understand order of operations conventions (BODMAS) and apply them to calculations. Note that the E-volve calculator does not currently automatically apply BODMAS to numbers inserted and candidates must take this into account if they are making continuous calculations.

Formulae

Some candidates have difficulty using formulae. They are expected to use simple algebraic formulae.
eg

$$S = \frac{100A}{E}$$

where S = percentage saving

A = amount saved in pounds

E = estimated annual cost for electricity
        from present supplier in pounds

4.2 Specific types of calculation

The following are examples of calculations that are not understood by a number of candidates:

- percentages
  eg recognition that 15 out of 50 (customers) is 30%
  eg recognition that 30% is the same as 3/10
- fractions
  eg calculation of one third as a price reduction, NB one third is **not** 33% for purposes of calculation
- ratio
  eg use of ratio 1 : 5 to make a dilution, NB 1 : 5 is **not** $\frac{1}{5}$
- time, particularly addition of time
  eg recognition that 38.5 hours is 38 hours 30 minutes
  eg 2hrs 49mins + 1hour 52mins = 4hours 41mins **not** 4hours 01mins
  eg 52:30 ÷ 3 = 17:30 not 17:43
- weight conversions
  eg 1.25kg = 1250g
- conversions from imperial measure to metric (conversion factors usually given)
  eg 8 feet = 2.4384m, given 1foot = 0.3048m
- currency conversions given conversion factor
  eg $640 = £402.52 given $1 =£ 1.59
  Note all decimal places should be used in the initial calculation
- calculation of areas
  eg of L-shaped floor areas
- calculation of volume
- metric conversion
  eg mm to cm
  eg cm (to m) to km ie recognition that 10mm = 1cm , 1000m = 1km
  eg g to kg
- scaling up
  eg use of 1cm represents 5km or scale 1: 500 000, map measurement is 4.5cm, so actual distance is 22.5km (4.5 x 500 000 = 2 250 000cm = 22.5km)
- scaling down
  eg use of 2cm to represent 5m or scale 1 : 250
- candidates generally calculate means and range accurately. A few confuse range with the mean or another type of average. Level 2 candidates must also understand how to calculate median and mode.
- many candidates show little understanding of the basic principles of probability. They need to be taught definitions, scales (0 to 1) or (0% to 100%), simple rules and the correct form for expressing probability, ie, fractions, decimals or percentages but not ratio
  eg there is a 60% chance that the average temperature in June will be greater than the July average
  eg the chance of picking the number 1 from a box containing numbers 1- 100 is 0.01
  eg the probability of the machine breaking down is $\frac{1}{500}$

4.3 Checking calculations

As part of a general checking process, candidates should be taught to ask themselves whether or not their answers make sense in the context of the task, eg the average price of a product cannot be more than the highest price in a list of prices.

Candidates are expected to be able to demonstrate simple checks of calculations or parts of calculations they have used. Checks must not be straightforward repeats of calculations and candidates are expected to use reverse checks, approximation or a different method. Candidates must have shown the original calculation in the relevant part of the task. Some candidates show checks of answers where no working has been shown – such checks are not awarded marks as the check required must specifically relate to a previous calculation shown. A number of candidates show reverse calculations that simply are original calculations written in reverse form taking no account of where rounding has occurred in their answer.

eg original calculation is $105.6 \div 2.75 = 38.4$ rounded to 38
acceptable checks: $38.4 \times 2.75 = 105.6$ (exact reverse calculation) **or** $38 \times 2.75 = 104.5$ with explanation that value is not exact because of rounding (ie value is of right order) **or** $105 \div 3 = 35$ (nearly 38.4)
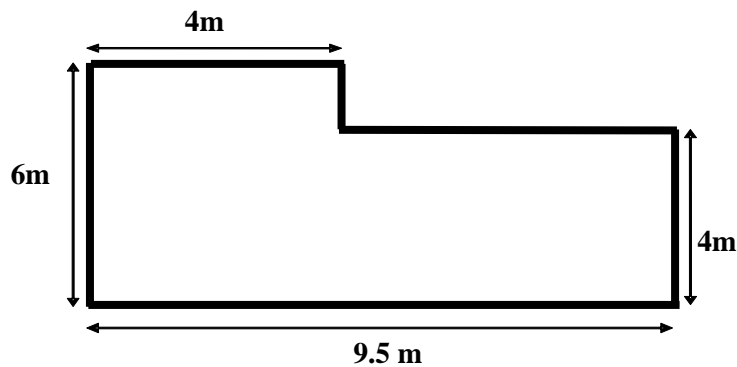not acceptable: $38 \times 2.75 = 105.6$ (incorrect calculation)

eg original calculation is $96.7 \div 2 = 48.35$
acceptable checks: $48.35 \times 2 = 96.7$ **or** $96.7 \times 0.5 = 48.35$

eg original calculation is £17.56 x 3 = £52.68
acceptable check: £17.56 + £17.56 + £17.56 = £52.68

eg showing a different method (eg different area breakdowns for L-shaped area),

original calculation area = $(4 \times 6) + (5.5 \times 4) = 46m^2$
acceptable check: area = $(9.5 \times 6) - (2 \times 5.5) = 46m^2$
or area = $(4 \times 2) + (9.5 \times 4) = 46m^2$

4.4 Explaining scales

Some of Task 2 checking relates to the interpretation of a scale plan/diagram. Candidates should be able to relate the scale used to a scaled length on a diagram. Some candidates lose marks by missing either reference to the scale or reference to the scaled length.

eg the scale is 1 : 100, so 6m (= 600cm) is 600 ÷ 100 = 6cm on the plan

eg the scale is 1 : 20 000, so 5cm on the map is 5 x 20 000 = 100 000cm = 1km

Although Level 2 candidates are expected to understand scales expressed in the above form, simpler explanations are also acceptable.

eg the scale is 2 squares = 1 metre, so 3 metres is 6 squares

eg 1cm represents 50cm and 6cm is 300cm = 3m

5. Interpret (presentation and explanation of results, evaluation of task)

5.1 Explanations
Candidates should be encouraged to put their conclusions into the context of the task brief. This makes the exercise more meaningful and encourages candidates to appreciate the relevance of what they have calculated. Simple statements that reiterate what a candidate's results show are required.

eg The floor area of Office A is not big enough
eg I chose items A, B, and C because they cost less than £85 (my budget)

If a comparison is asked for, candidates must use a statement that compares results.

eg Option A, it's cheaper (than Option B)
eg Emmerford is 6 miles further than Stanham

When interpreting statistical calculations there is often a requirement to make comments on a measure of location (average) and one on a measure of dispersion (range). Most candidates correctly calculate the range as the measure of dispersion but fail to conclude that a small range is normally preferable to a large range in that it shows a greater degree of consistency in the data. Many candidates have difficulty in expressing what they have found out from the results of their calculations, particularly the interpretation of range, where a reference to variation or consistency is expected. Suitable explanations will include references to both range and average.

eg Boys do more exercise than girls, mean 55 minutes per day compared to 43.5 minutes, but exercise for boys is more varied as the range for boys is higher than range for girls

5.2 Graphical support
Candidates must be able to summarise their results and support their explanations using a variety of presentation techniques.

Task 1
Candidates are expected to summarise results in a coherent way. Results of calculations are frequently required in table format. At Level 2, candidates are expected to extract the required results (and therefore headings) from the text of the question instructions. A few candidates lose all marks for questions requiring a table by drawing charts or graphs. Candidates should be encouraged to plan tables to summarise results in a logical format. Data entered in tables must be consistent with results previously calculated.

Candidates using the E-volve option must use the table creator tool for tables, timetables and flow charts.

Candidates must arrange results in headed rows and columns, draw lines to show the rows and columns (paper-based only) and accurately record results.

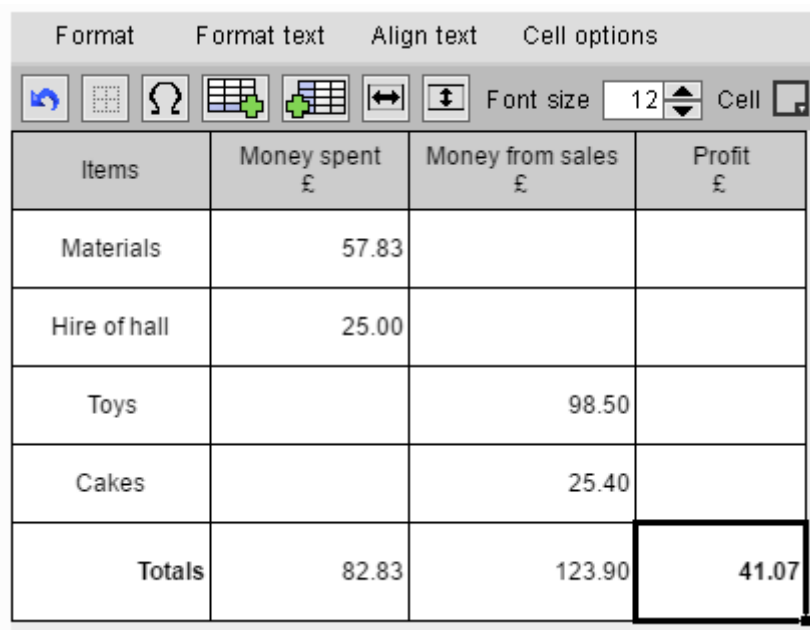When tables are constructed, marks are lost by some candidates who:
- fail to delineate rows and columns (paper-based)
- do not head rows and columns with suitable labels
- do not accurately enter the results / data required.

Examples of tables showing results from sales at a local community event

Paper-based:

Items	Money spent (£)	Money from sales (£)	Profit (£)
Materials	57.83		
Hire of hall	25.00		
Toys		98.50	
Cakes		25.40	
Totals	82.83	123.90	41.07

E-volve (Table Creator):

Simple timetables, time lines or flow charts may also be required.

Examples of simple flow charts showing a plan to cook a chicken dinner
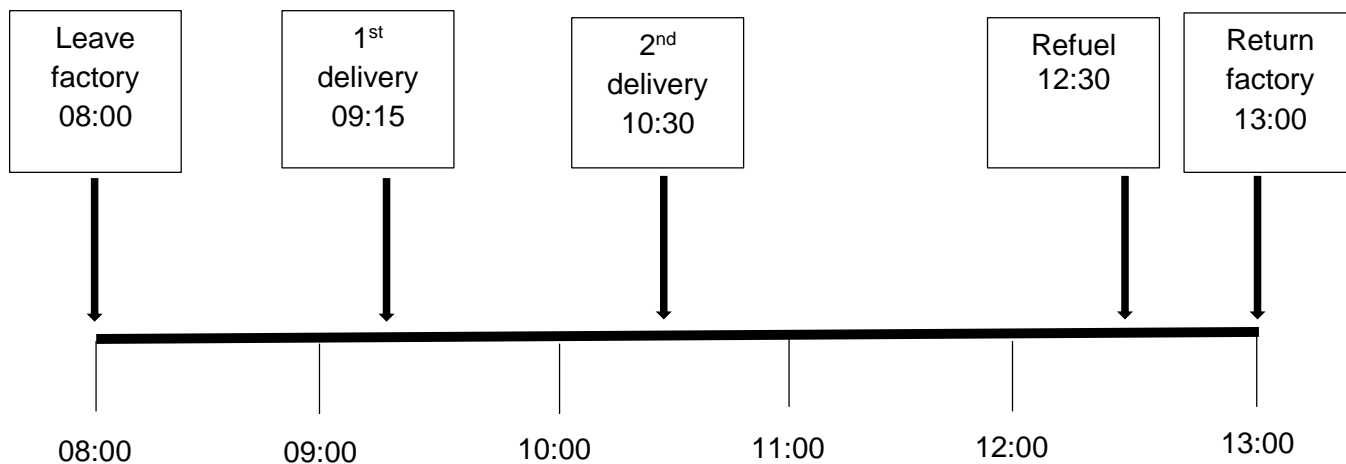
Paper-based:

```
┌──────────────┐      ┌──────────────┐      ┌──────────────┐
│ Put chicken  │─────▶│ Put roast    │─────▶│ Put sausages │
│ in oven      │      │ potatoes in  │      │ in oven 19:15│
│ 18:30        │      │ oven 19:00   │      │              │
└──────────────┘      └──────────────┘      └──────────────┘
                                                    │
                                                    ▼
┌──────────────┐      ┌──────────────┐      ┌──────────────┐
│ Meal ready   │◀─────│ Microwave    │◀─────│ Steam        │
│ 19:45        │      │ gravy 19:40  │      │ vegetables   │
│ TOTAL TIME   │      │              │      │ 19:25        │
│ 1 hour 15 minutes│  └──────────────┘      └──────────────┘
└──────────────┘
```

E-volve (Table Creator):

Format   Format text   Align text   Cell options

Font size 12 Cell Text
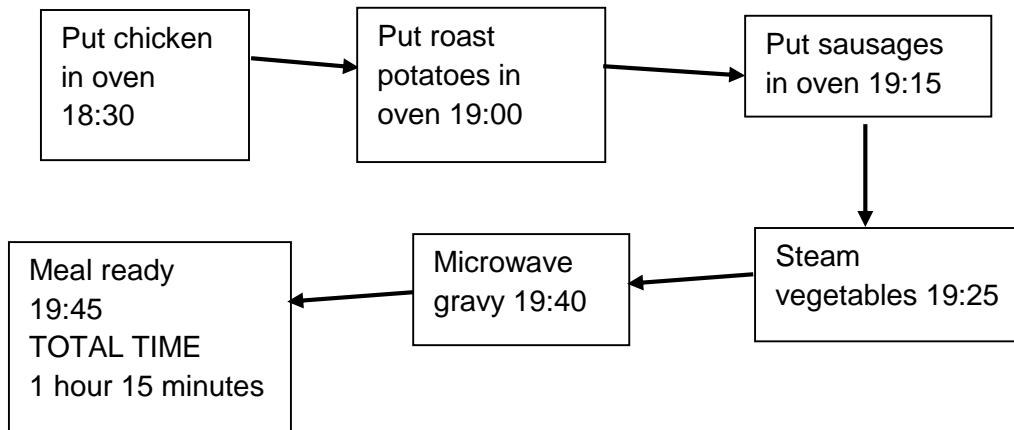
Plan for cooking roast dinner

time	18:30		19:00		19:15		19:25		19:40		19:45
activity	chicken in oven	>>	roast potatoes in oven	>>	sausages in oven	>>	steam vegetables	>>	microwave gravy	>>	Meal ready

Examples of simple time lines showing deliveries by lorry

Paper-based:

| Leave factory 08:00 | 1st delivery 09:15 | 2nd delivery 10:30 | | Refuel 12:30 | Return factory 13:00 |

```
08:00        09:00        10:00        11:00        12:00        13:00
```

E-volve (Table Creator):

Format		Format text		Align text	

time	delivery	time	delivery
08.00	leave	11:00	
09:00		12:00	
09:15	1st		
		12:30	refuel
10:00		13:00	return
10:30	2nd		

Simple summaries of results are needed – so long as candidates provide accurate, complete summaries that are coherent and clearly presented, they will achieve marks.

Task 3

Candidates are expected to support their results with suitable charts or graphs, including scatter graphs. They must be able to draw a line of best fit (by eye) on a scatter graph to show relationships between variables or add a point to an existing scatter graph from a calculated result. They should be able to show probability using a simple scaled line.

Some candidates lose all marks for this question because they do not produce the required graphic, eg produce a line graph or table when instructed to draw a chart. They should understand that a line graph is only an option if the data plotted is continuous data. It is not an option if the results illustrated are discrete. Pie charts are suitable only if there is an intention to show proportions. A table is not a chart.

Bar charts

A bar chart should have a title, axes labelled, bars labelled (a key is also acceptable), a scale starting at zero and bar heights accurately plotted.

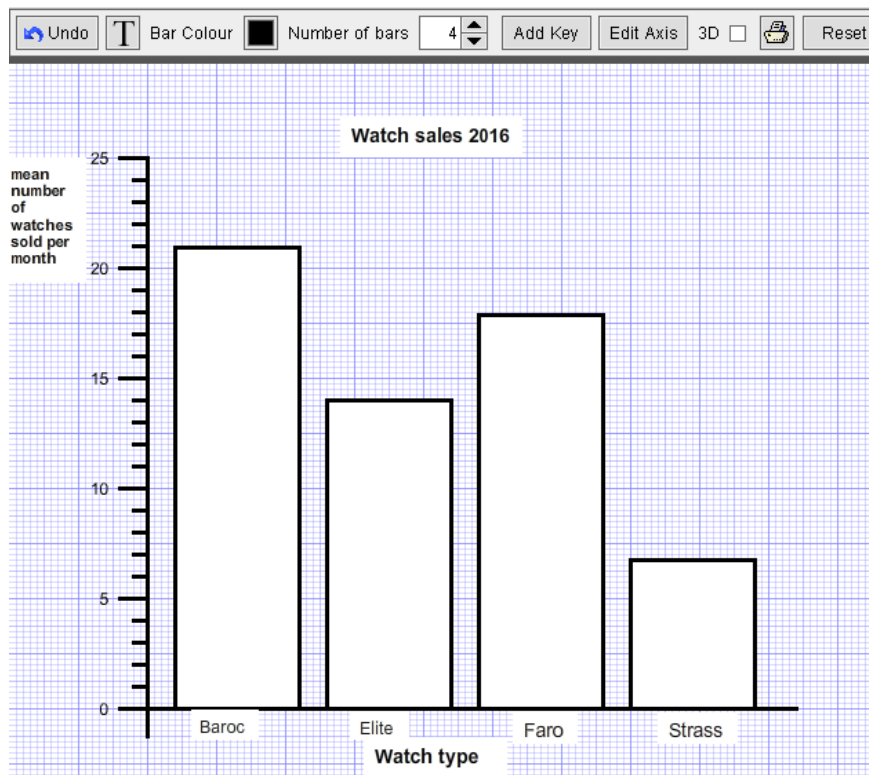When bar charts are drawn, marks are lost by some candidates who:
- fail to label axes, particularly the vertical axis
- do not construct a continuous linear scale on the vertical axis
- fail to start the vertical scale at zero
- do not draw bar heights accurately.

Examples of bar charts showing watch sales

## Paper-based:
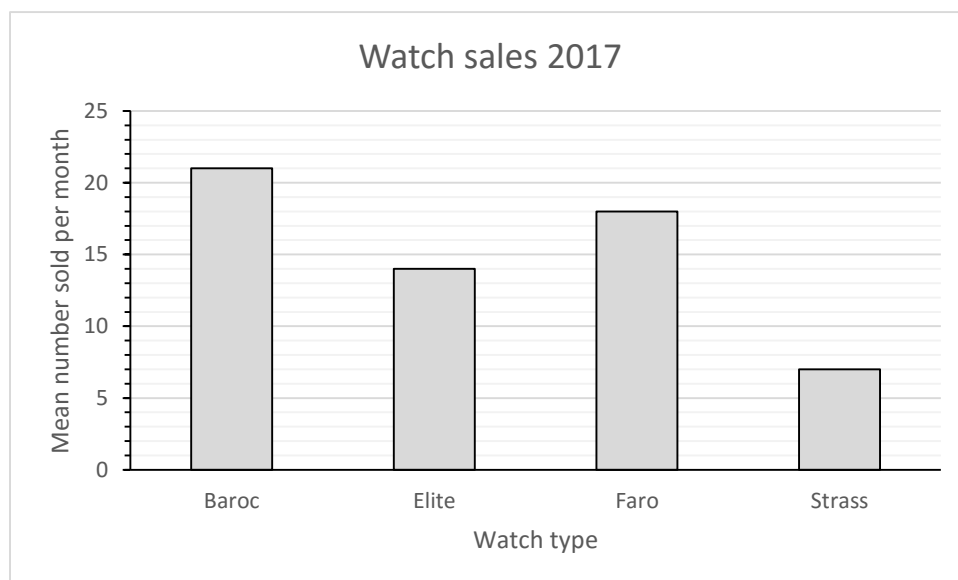
E-volve (Graph Creator):

Pie charts

A pie chart should have a title, segments labelled or a key provided, and sector angles accurately drawn. It must only be used where the intention is to show proportion. A circular template will normally be provided and candidates will require a protractor to measure angles in paper-based assessments.

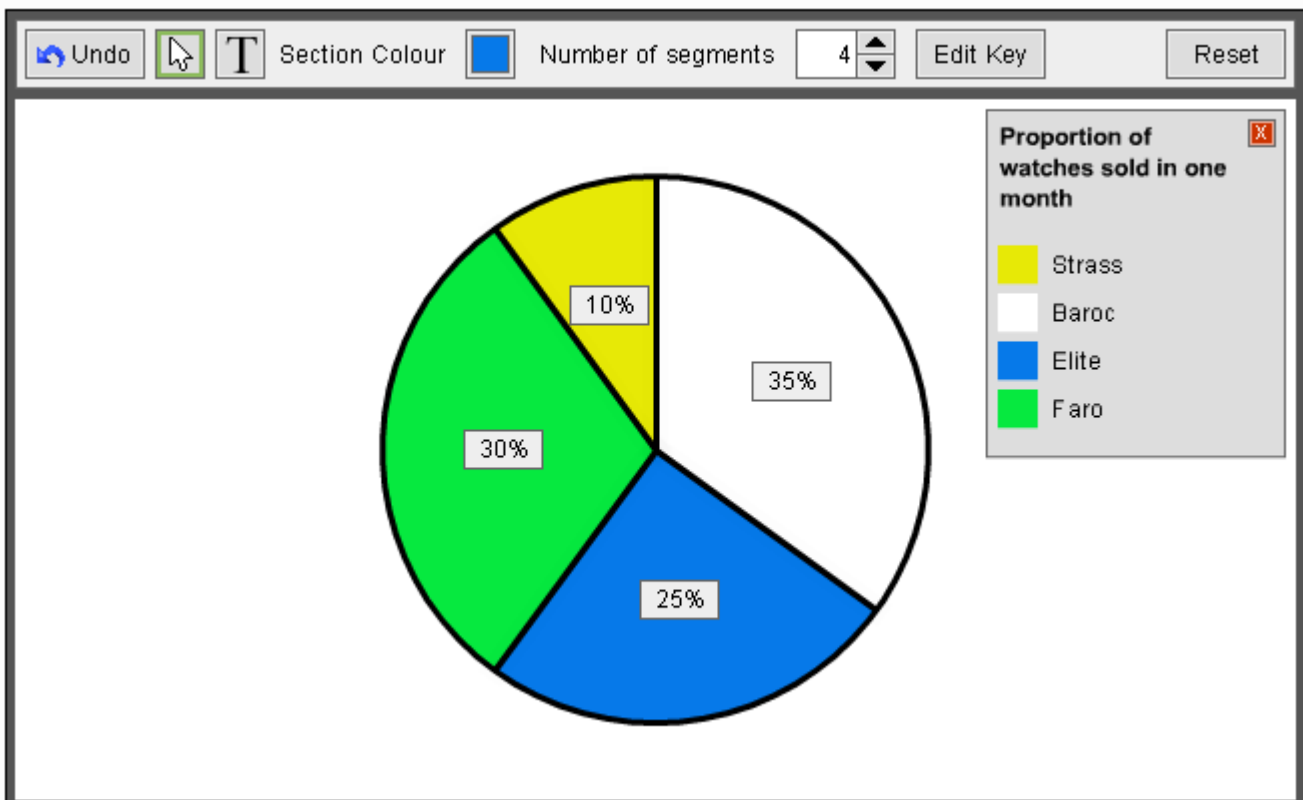When pie charts are drawn, marks are lost by some candidates who:
- cannot relate proportion / percentage to 360°
- do not draw sector angles accurately.

Examples of pie charts showing proportion of different watches sold

Paper-based:
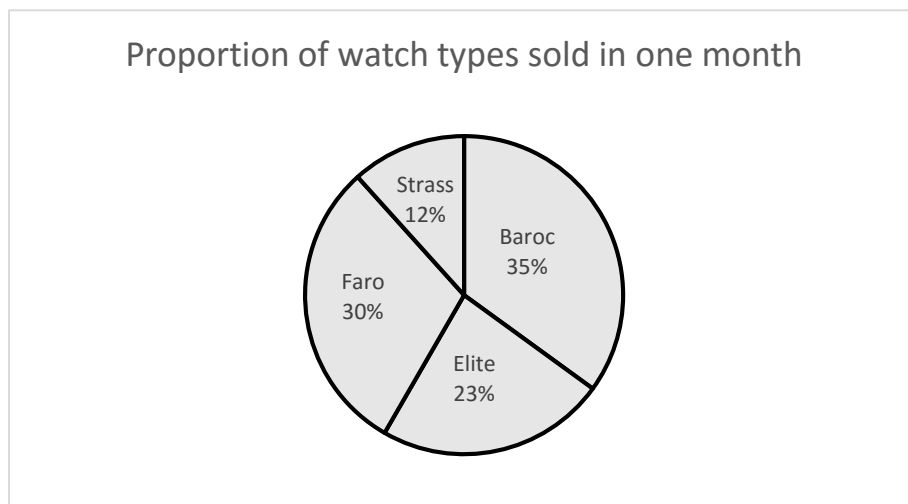
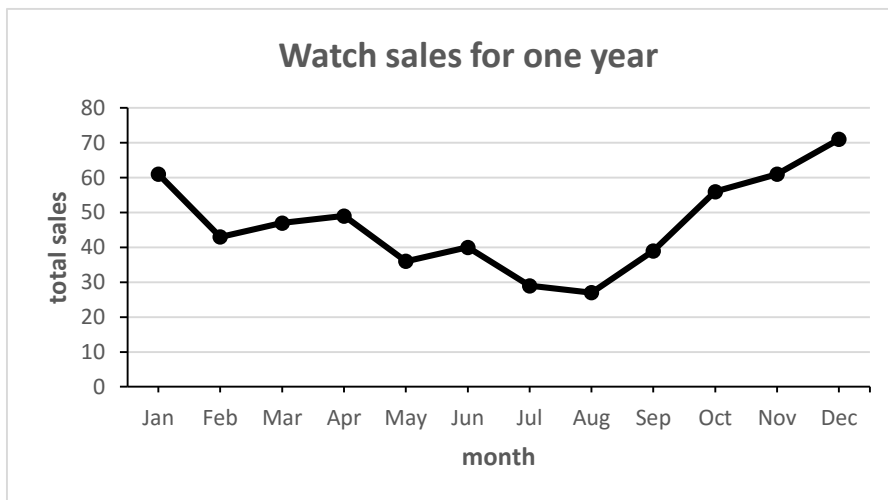
E-volve (Graph Creator):

Line graphs

A line graph should have a title, labelled axes, continuous linear scales on both vertical and horizontal axes, the vertical scale may start at zero (if it does not, a broken line symbol should be used), accurate plots shown clearly and a single line joining the plots.

When line graphs are drawn, marks are lost by some candidates who:
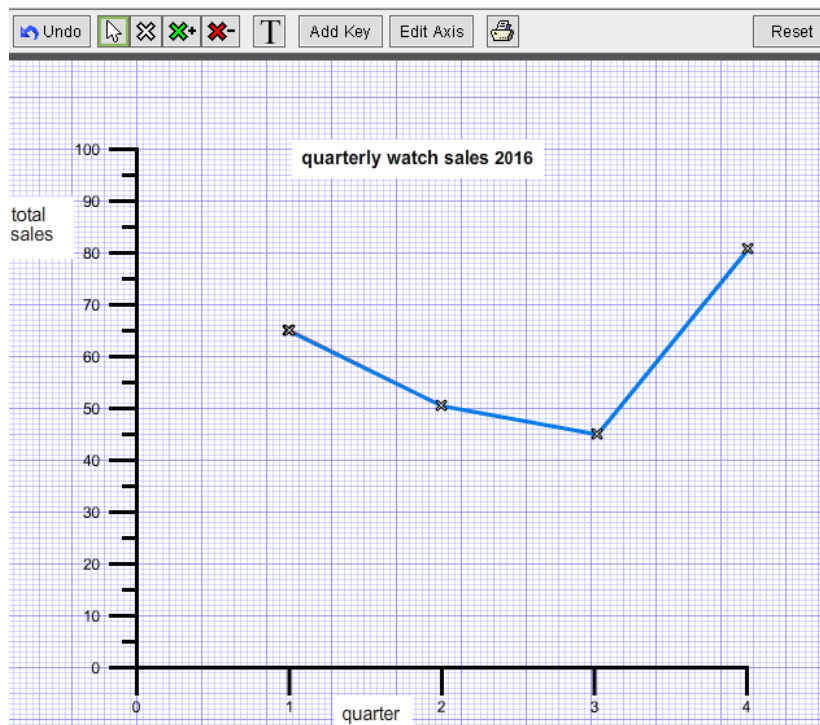- fail to label axes, particularly the vertical axis
- do not construct a continuous linear scale on the vertical axis
- do not plot accurately.

Examples of line graphs showing total sales per month over a continuous period (one year)

Paper-based:

### E-volve (Graph Creator):

Probability scales

Probability can be shown on a simple scale line starting at zero (no chance), ending at 1 or 100% (certain), labelled with the calculated probability drawn to scale. Even if a candidate incorrectly calculates a probability value, they may achieve some marks for showing the (incorrect) value on a probability scale.

When probability scales are drawn, marks are lost by some candidates who:
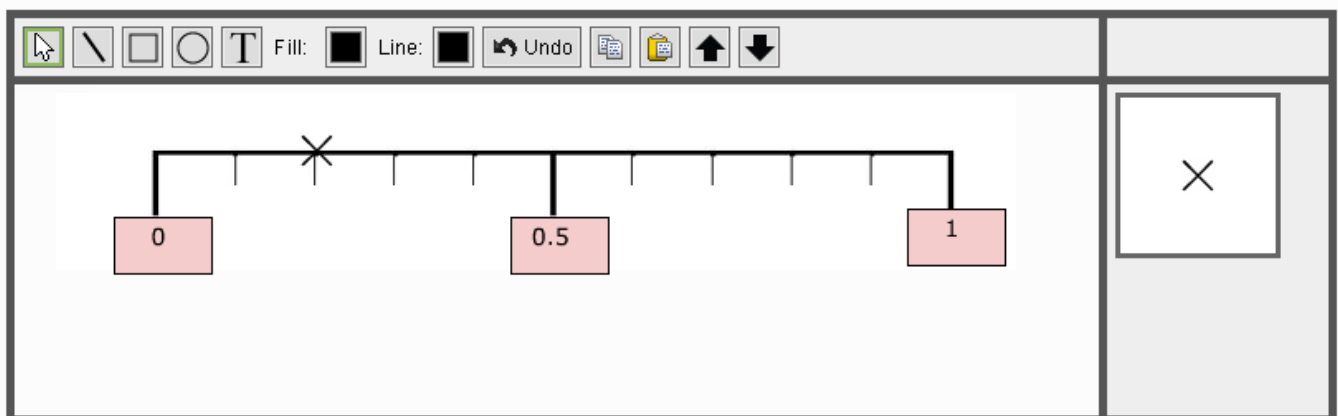- fail to label the extremes of the scale (using the % sign if labelling 0 – 100)
- do not construct a continuous linear scale
- do not recognise the difference between single and double digit percentages (eg, mark 5% as 0.5 on the scale).

Examples of probability scales showing a 1 in 5 chance (probability 20% or 0.20)

Paper-based:
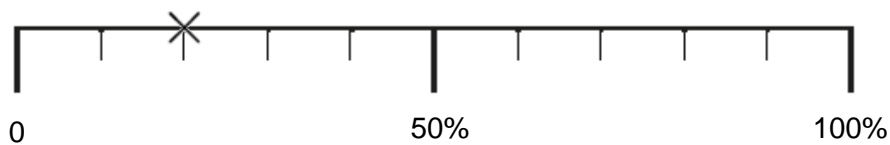
E-volve (Probability Scale):

Trends lines (line of best fit)

Candidates must be able to draw a trend line (line of best fit) through given plots. They are expected to draw a straight line 'by eye', which goes through the plots with approximately equal numbers of plots on either side of the line. Candidates may be required to add a plot from calculated results and to extrapolate (extend) the trend line to predict further values.

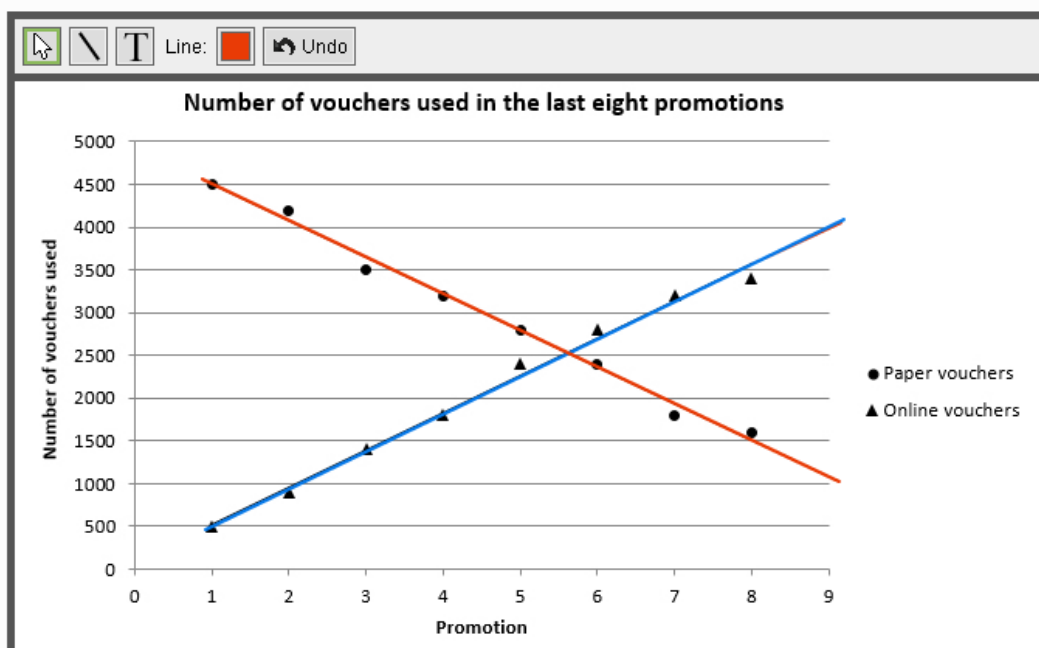When trend lines (lines of best fit) are drawn, marks are lost by some candidates who:
- join each plot to the next plot
- draw lines through the origin of their graph
- do not draw the line cross the whole range of points.

Examples of trend lines (line of best fit)

Paper-based:
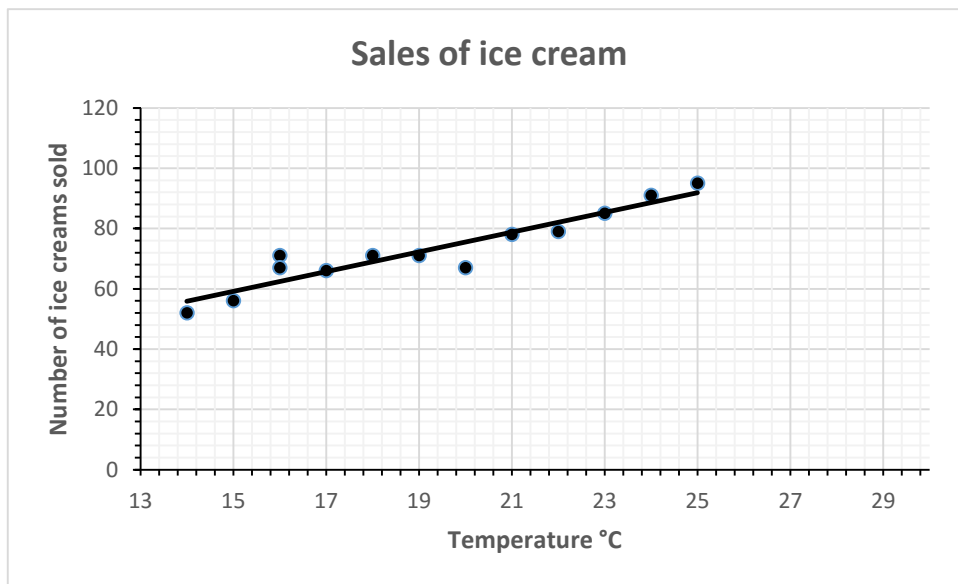
E-volve (Graph Creator):

5.3 Review and evaluation

In Section 4.3 it was stated that, as part of a general checking process, candidates should be taught to ask themselves whether or not their answers make sense in the context of the task. This is a first step to evaluating their work.

Candidates will be required to show that they can reflect on their approach to the task by commenting on their methods and results. At Level 2, a basic level of review and evaluation is required. Candidates are expected to make a few brief comments that relate to what they have done. They are prompted to make comments about one or more of the following in the context of the work they have done:

- any other information that they would have liked
- how sensible their answers seemed to be
- how well their methods worked
- anything they found difficult
- things they might do differently if you had to tackle a similar problem.

Candidates must relate their comments to specific parts of the task they have undertaken. Generic comments such as 'I think my answers are sensible because I checked them', will not be awarded marks. Similarly, comments about other information that has already been given or generalised difficulties about types of calculation are unacceptable. Things to do differently must be relevant to the task.

Examples of acceptable and not acceptable comments:

Example for "any other information that they would have liked"
Acceptable: I would like more information about possible time delays to my journey (task related driving from A to B to arrive at a specific time)
Not acceptable: I would like to know if I could drive faster (average speed given as part of question – not negotiable)

Example for "how sensible their answers seemed to be"
Acceptable: my answers were sensible as the two amounts to pay were similar and I could choose one
Not acceptable: my answers were sensible because I checked them (a generic answer that could be learnt and applied to any task context)

Example for "how well their methods worked"
Acceptable: my methods worked well because I rechecked the area of the room by different method (calculation of the area of an L-shaped room requiring flooring)
Not acceptable: my methods worked well and I used the best calculations (non-specific)

Example for "anything they found difficult"
Acceptable: I found changing yards into metres difficult (some linear measurements given in imperial units but solution requires area in m^2)
Not acceptable: I did not understand the question

Example for "things they might do differently if you had to tackle a similar problem"
Acceptable: I would work out the VAT on the total amount instead of working it out for each item, it would save time (addition of a number of items for a bill requiring VAT)
Not acceptable: I would make sure I read the question more carefully and left more time to do the second part

6. Example assessment tasks / section

Sample papers, worked examples, commentaries and mark schemes are available on the City and Guilds website.