

LEVEL 3 CERTIFICATE

Topic Exploration Pack

H866/H867

QUANTITATIVE PROBLEM SOLVING (MEI)

QUANTITATIVE REASONING (MEI)

Risk

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This activity offers an opportunity for maths skills development.

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Introduction

Understanding the language associated with risk, being able to interpret a risk assessment and indeed create one have become essential skills in the modern work-place. With an ever-increasing emphasis on health and safety the creation of a risk assessment is seen as a crucial step in ensuring that an activity is completed safely, without injury or health problems. Companies, businesses and schools etc. that have accidents whilst conducting an activity, make themselves liable to court action if their risk assessment is deemed unacceptable. The understanding of these concepts is very important and companies spend time and money ensuring that their employees understand how to make an effective risk assessment.

In terms of the mathematics involved; it is very simple. The ability to multiply numbers up to 5×5 should be a given at this stage but the interpretation of probabilities is a bit trickier. In our everyday lives we often state probabilities as “there is a one in n chance” and this is actually an accurate way of stating the probability. However mathematically this isn’t very useful and an ability to convert this into a number between 0 and 1 is important. A key concept is

- A probability stated as 1 in n chance is written as a probability of $\frac{1}{n}$.

Knowing a probability for something occurring is usually not enough when writing a risk assessment. For example, imagine you are a teacher and organising a coach trip to the zoo. You might decide that there is a 1 in 1000 chance that the coach will crash. This is a small probability of $0.001 = 0.1\%$, but the likely effect of a crash is severe. Compare this to the event of someone getting travel sickness on the coach trip. The probability of this happening is probably higher, say 1 in 3, which is 33%; however, the severity of this is lower than the bus crash. These concepts are investigated when using a *risk assessment matrix*, which involves basic multiplication.

The key concept of evaluating risk and completing a good risk assessment is that the person who formulates a risk assessment is not directly responsible for any events that occur, as long as the recommendations given by the risk assessment are followed. After deciding that the coach trip is of certain risk to crash, it is up to the person writing the assessment to decide upon measures which lowers the risk of the crash occurring. You will never minimise risk entirely, that is the nature of the world that we live in, but identifying as many possible risks and their severities as possible means accidents are far less likely to occur.

The real skill of risk evaluation is not just identifying the risk; it’s ascertaining how to implement measures that lower risk, once a risk has been identified.

The activities described below correspond as closely to the real world as possible and allow learners to practise and consolidate their skills. This is an excellent topic to teach because it is clearly a ‘real-world’ problem that learners will be able to relate to and hopefully enjoy studying.



Activity 1 – Interpreting Probability

Activity 1.1

This simple activity helps learners to convert between probabilities stated as odds; ‘one in n ’, and probabilities stated as percentages: $\frac{1}{n} \times 100\%$.

Activity 1.1 is a short activity which can be used as a starter to a lesson. The idea is that learners have to match the probabilities to the odds. This can be introduced quite simply by a worked example:

Imagine something has odds of happening as ‘4 in 7’ chance. Then the probability as a percentage can be calculated by writing the odds as a fraction and then multiplying by a 100; in this case

$$\frac{4}{7} \times 100\% = 57.1\%$$

Matching pairs are indicated in the grid below:

1 in 8	37.5%	60%	1 in 10
14.3%	1 in 9	3 in 10	12.5%
10%	30%	80%	1 in 7
4 in 5	3 in 8	11.1%	3 in 5



Activity 1.2

In this activity learners work out the odds of accidents happening and then they calculate the associated probability of the accidents happening using the methods described below. Again, this is a short activity which can be used as part of a lesson and serves as an example of calculating probabilities from actual data.

A factory manufacturing heavy machinery records accidents over a 52 week year. They note the following instances of accidents occurring:

- 109 instances of minor cuts
- 52 instances of trips/falls leading to no injury
- 11 instances of smoke inhalation due to welding fumes
- 1 case of serious injury resulting in loss of limb

There are 250 employees that work at the factory. Assuming that an employee can have only one accident in a year, calculate the following occurring in a given year:

- The probability of a minor cut as odds and a percentage.
- The probability of a trip/fall leading to no injury as odds and a percentage.
- The probability of smoke inhalation as odds and a percentage.
- The probability of a serious injury as odds and a percentage.

Answers

- a) The probability of a minor cut as odds and a percentage:

$$109 \text{ in } 250 \text{ chance: } \frac{109}{250} = 0.436 = 43.6\%$$

- b) The probability of a trip/fall leading to no injury as odds and a percentage:

$$52 \text{ in } 250 \text{ chance: } \frac{52}{250} = 0.208 = 20.8\%$$

- c) The probability of smoke inhalation as odds and a percentage:

$$11 \text{ in } 250 \text{ chance: } \frac{11}{250} = 0.044 = 4.4\%$$

- d) The probability of a serious injury as odds and a percentage:

$$1 \text{ in } 250 \text{ chance: } \frac{1}{250} = 0.004 = 0.4\%$$



Activity 2 – Writing a Risk Assessment

Activity 2.1a

In this extended activity learners create a risk assessment for a school trip to the zoo. This activity could take place over 1 or 2 lessons as the work is quite involved.

In the first part of the activity learners are to complete the *risk matrix* by multiplying the likelihood number by the severity number. It is advisable to discuss with the learners what values should be assigned to the different level of risk and how this can be displayed. Using the following suggested values and colour key, the risk matrix should look like the table below:

- Less than 5 – No/Low risk 
- Between 10 and 14 – Medium/Acceptable risk 
- Over 14 – High/Unacceptable risk 

Likelihood/Severity	Insignificant (1)	Minor (2)	Moderate (3)	Major (4)	Severe (5)
Almost Certain (5)	5	10	15	20	25
Likely (4)	4	8	12	16	20
Possible (3)	3	6	9	12	15
Unlikely (2)	2	4	6	8	10
Rare (1)	1	2	3	4	5



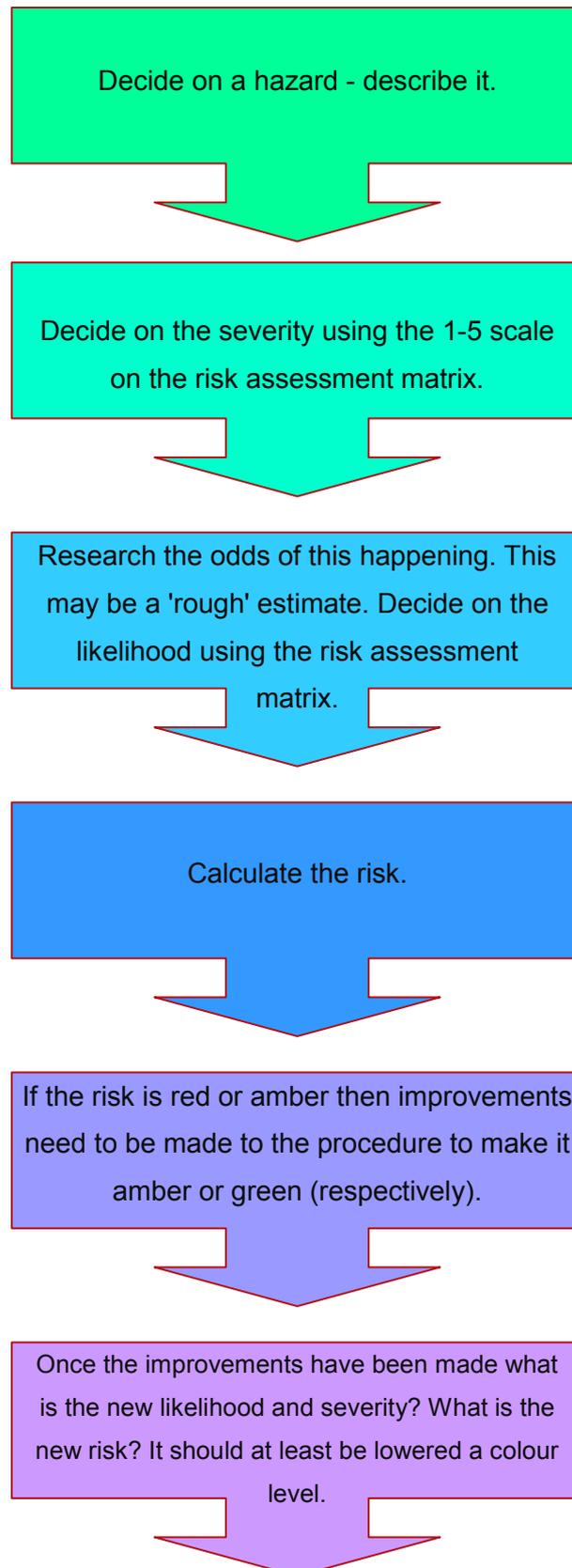
Activity 2.1b

In the second part of this activity learners have to risk assess potential hazards encountered on a school trip to the zoo. An itinerary for the day is provided (see below), along with a risk assessment template, which may need to be enlarged when reproduced so that learners can write in the boxes comfortably. Alternatively, the template could be completed electronically.

Type of Activity – Educational Visit
Date – Tuesday 10 th March 2015
Timeline
09.00am Students meet in the school car park
09.15am Students board the bus
09.20am Coach departs for the zoo
10.00am Coach arrives at the zoo
10.15am Students enter the zoo
12.30pm Lunchtime
13.15pm Students have the opportunity to go to the gift shop
13.30pm Students meet at the pre-arranged meeting point in the zoo ready for departure
13.45pm Students exit the park and board the coach
14.00pm Coach departs for the school
14.45pm Coach arrives back at the school
Numbers – 17 boys, 21 girls, 1 male teacher, 1 female teacher
First Aid Kit – YES
Permission Slips – All 38 slips have been returned and all 38 parents have given permission for their child to go on the trip. Only 35 have given permission for their child to enter the poisonous snake compound. One parent has written to ask if their child can be left at the zoo so they can pick them up on their way back from work. This student will be picked up from the zoo at 2.00pm.



Learners have to identify all the likely hazards first and this can be done best in small discussion groups. A risk assessment is required for each hazard identified. The process of completing the risk assessment is illustrated in the following flow chart:



The biggest difficulty for learners will be their potential lack of life experience in determining what denotes a hazard or not. It may be useful to spend time at the beginning of the lesson deciding on what constitutes a hazard or not and then work through the six steps of the risk assessment process with an example; completing the first row of the risk assessment.

As an example, we could have the students meeting in the car park to wait for the bus at the beginning of the trip. This is how the risk assessment could be completed for this hazard:

Hazard	When waiting for the bus in the car park a student / member of staff may get hit by a vehicle.
Likelihood	2
Severity	5
Risk	$2 \times 5 = 10$
People at Risk	Students + Staff
Control Measures	<ul style="list-style-type: none"> • Make sure students are waiting for bus in a safe area before embarking on the bus • Make sure students enter bus in single file • Staff to wear high-visibility clothes
Amended Likelihood / Severity	$\frac{1}{5}$
Reduced Risk	$1 \times 5 = 5$ Low Risk

You could use examples from the school/college you are in as a basis for the trip. Look at existing risk assessments (there must be some) for ideas. It could be that you decide to change the trip to the zoo to an actual trip that the college will do in the future/has done in the past in order to make the activity more relevant.



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