

National 5 Mathematics



Guidance on gathering key evidence for producing estimates in session 2020–21

This document provides subject-level guidance to SQA approved centres on gathering key evidence to support estimates for National 5 Mathematics in session 2020–21. You should read this guidance alongside [National Courses: guidance on gathering evidence and producing estimates](#) and the SQA Academy resource, [Quality assurance of estimates for National Courses](#).

This document also includes information on subject-level assessment resources.

Gathering key evidence to produce estimates for National 5 Mathematics

Every year you provide estimates for your candidates. This document and *National Courses: guidance on gathering evidence and producing estimates* will give you additional support and guidance to support your decision making for session 2020–21. Evidence should be gathered later in the course, as a realistic reflection of a candidate's attainment. It is important to note that it is not the **quantity** of evidence, but the **quality** of evidence, in relation to its predictive value, that will support you during the estimation process.

The following types of key evidence are likely to provide a good predictive value and may be helpful, although there may be other types of key evidence you feel you would like to use.

Types of key evidence and assessment resources

In mathematics, internal exams are a better predictor of candidate performance than smaller class tests. Class tests may provide additional useful evidence, but on their own are unlikely to provide the breadth, depth and challenge of the course assessment.

Internal exams should, as far as possible, match the course assessment in terms of breadth, depth and challenge. (See below for further details.) You should not use past papers in their entirety. However, you can use questions from past papers in internal exams. The question analysis tables at the end of this document may help you to determine whether the questions you use assess skills at a particular grade.

Using additional assessment resources for session 2020–21: key information

It is important that you use valid and reliable assessment when gathering evidence to produce estimates for National 5 in session 2020–21.

In National 5 Mathematics, SQA will provide question papers for session 2020–21, which you can use when gathering evidence to support your estimates. Please note that the marking instructions have not been standardised based on candidate responses. You may therefore need to agree within your centre how to consistently mark an item if a candidate response is not covered by the marking instructions.

The National 5 question papers will only be available on SQA's secure website — you must treat these confidentially, in the same way as other live assessment materials.

You should carefully consider how best to use these materials to support candidates, to integrate with your programme of learning, and to help you collate evidence of candidate attainment. Given current public health advice and to maximise learning and teaching time, it is important to stress that there is no expectation that schools and colleges hold a formal diet of prelims for National 5. One of the key reasons for moving to an alternative model was to create additional teaching time through removing the need for prelims and replacing the final examination diet with more flexible classroom-based assessment.

If you use a question paper in part or in its entirety, you should remind candidates that they must not discuss the content of the paper with anyone, including friends, family or on social media.

Understanding the national standard

What is reliable internal evidence?

The closer the internal evidence is to the standard, format and duration of the course assessment, the more reliable it should be.

The course assessment

The course assessment meets the key purposes and aims of the course by addressing:

- ◆ breadth — drawing on knowledge and skills from across the course
- ◆ challenge — requiring greater depth or extension of knowledge and/or skills
- ◆ application — requiring application of knowledge and/or skills in practical or theoretical contexts as appropriate

This enables candidates to:

- ◆ demonstrate mathematical operational skills
- ◆ integrate mathematical operational skills developed throughout the course
- ◆ demonstrate mathematical reasoning skills
- ◆ apply numerical calculation skills without the use of a calculator to demonstrate an underlying grasp of mathematical processes

Approximately 65% of the marks are available for questions assessing grade C skills.

Approximately 65% of the marks are available for questions assessing only operational skills.

Approximately 35% of the marks are available for questions assessing operational and reasoning skills.

What type of questions assess skills at grade C?

At grade C, candidates typically demonstrate competence in the following:

Numeracy

- ◆ rounding to a given number of significant figures
- ◆ calculations using scientific notation
- ◆ working with reverse percentages
- ◆ working with appreciation and depreciation
- ◆ working with fractions

Algebra

- ◆ working with algebraic expressions involving expansion of brackets
- ◆ completing the square in a quadratic expression with unitary x^2 coefficient
- ◆ determining the equation of a straight line
- ◆ using functional notation
- ◆ solving equations and inequations with integer coefficients
- ◆ solving simultaneous equations (Where questions are set in context, some candidates fail to achieve the final mark for communicating the answer in the context of the question.)
- ◆ solving a quadratic equation using the quadratic formula

Geometry

- ◆ determining the gradient of a straight line, given two points
- ◆ calculating the length of an arc and the area of a sector (Some candidates are unable to carry out the calculations correctly when these questions are in paper 1.)
- ◆ working with three-dimensional coordinates
- ◆ adding or subtracting two- or three-dimensional vectors using components
- ◆ calculating the magnitude of a vector

Trigonometry

- ◆ working with the graphs of trigonometric functions (except those involving phase angle)
- ◆ calculating the area of a triangle using trigonometry
- ◆ using the sine rule and cosine rules to find a side or angle in a triangle

Statistics

- ◆ calculating the semi-interquartile range and standard deviation
- ◆ determining the equation of a best-fitting straight line on a scattergraph and using it to estimate y given x

This list is not exhaustive but indicates typical areas of competence across a broad range of skills.

What type of questions assess skills at grade A?

At grade A, candidates typically demonstrate a consistently high level of performance in relation to the skills, knowledge and understanding for the course. There is evidence that they are able to apply their knowledge in unfamiliar contexts, and in questions that integrate one or more skills and require a high degree of reasoning.

No skills are considered to be grade A in themselves but more challenging aspects of some skills may be. The context of the question, integration with other skills, and level of communication required in the solution contribute to the additional depth and challenge required for a candidate to demonstrate performance at this level.

What type of questions assess reasoning skills?

Questions assessing reasoning skills are those that include:

- ◆ interpreting a situation where mathematics can be used and identifying a strategy
- ◆ explaining a solution and relating it to context

Questions that involve both operational and reasoning skills may be at grade C or grade A.

Examples of questions at grade A

Questions at grade A include those that:

- ◆ assess more challenging aspects of some skills
- ◆ demonstrate sustained reasoning
- ◆ are set in more challenging and/or unfamiliar contexts
- ◆ assess integration of skills

The following examples should provide a basis on which to judge whether other questions assess skills at grade A.

Assess more challenging aspects of some skills

Evaluate $8^{\frac{5}{3}}$.

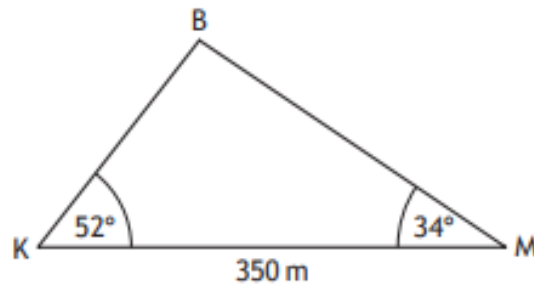
Solve the equation $\frac{x}{2} - 1 = \frac{3-x}{5}$.

Express $\sin x^\circ \cos x^\circ \tan x^\circ$ in its simplest form.
Show your working.

Demonstrate sustained reasoning

Katy and Mona are looking up at a hot-air balloon.

In the diagram below, K, M and B represent the positions of Katy, Mona and the balloon respectively.



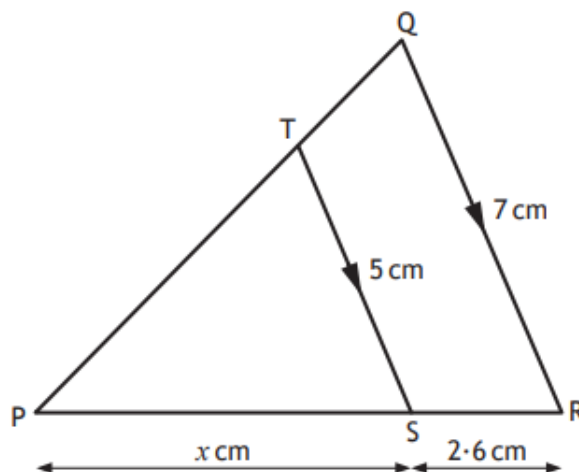
- The angle of elevation of the balloon from Katy is 52°
- The angle of elevation of the balloon from Mona is 34°
- Katy and Mona are 350 metres apart on level ground

Calculate the height of the hot-air balloon above the ground.

Demonstrate sustained reasoning

In the diagram below:

- TS is parallel to QR
- TS = 5 centimetres
- QR = 7 centimetres
- SR = 2.6 centimetres



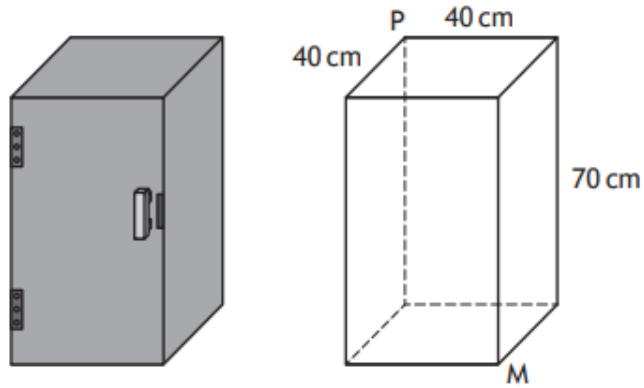
The length of PS is x centimetres.

Calculate the value of x .

Are set in more challenging and/or unfamiliar contexts

Chris wants to store his umbrella in a locker.

The locker is a cuboid with internal dimensions of length 40 centimetres, breadth 40 centimetres and height 70 centimetres.



The umbrella is 85 centimetres long.

He thinks it will fit into the locker from corner P to corner M.

Is he correct?

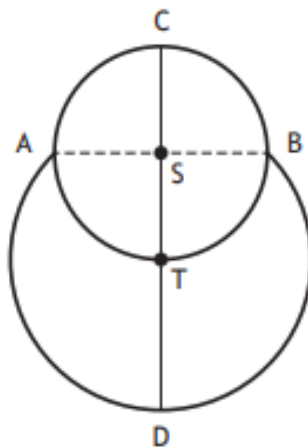
Justify your answer.

Are set in more challenging and/or unfamiliar contexts

The picture shows a cartoon snowman.



The diagram below represents the snowman.



- The head is a small circle, centre S , with diameter 15 centimetres
- The body is part of a larger circle, centre T
- The point T lies on the circumference of the small circle
- The points A and B lie on the circumferences of both circles

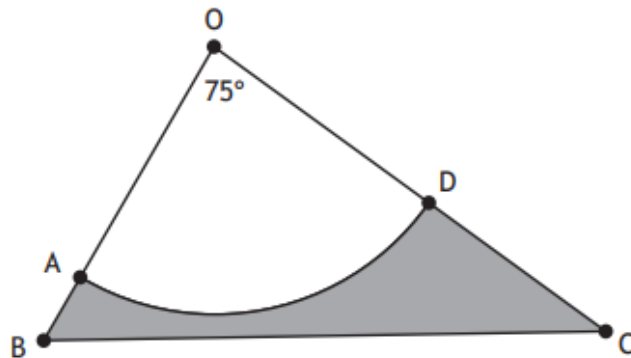
Calculate CD , the height of the snowman.

Assess integration of skills

Find an expression for the gradient of the line joining point A(6,9) to point B(4p,4p²).

Give your answer in its simplest form.

In the diagram below AOD is a sector of a circle, with centre O, and BOC is a triangle.



In sector AOD:

- radius = 30 centimetres
- angle AOD = 75°.

In triangle OBC:

- OB = 38 centimetres
- OC = 55 centimetres.

Calculate the area of the shaded region, ABCD.

Express $\frac{\sqrt{2}}{\sqrt{40}}$ as a fraction with a rational denominator.

Give your answer in its simplest form.

Examples of questions that assess operational and reasoning skills

The following examples should provide a basis on which to judge whether other questions assess operational and reasoning skills.

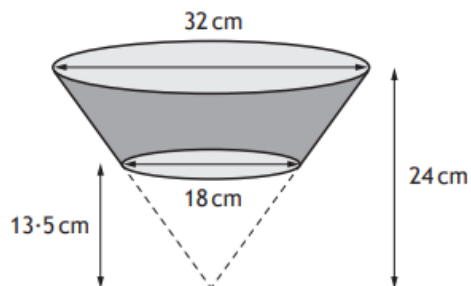
Interpreting a situation where mathematics can be used and identifying a strategy

Grade C

A carton is in the shape of a large cone with a small cone removed.

The large cone has diameter of 32 cm and height 24 cm.

The small cone has diameter of 18 cm and height 13.5 cm.

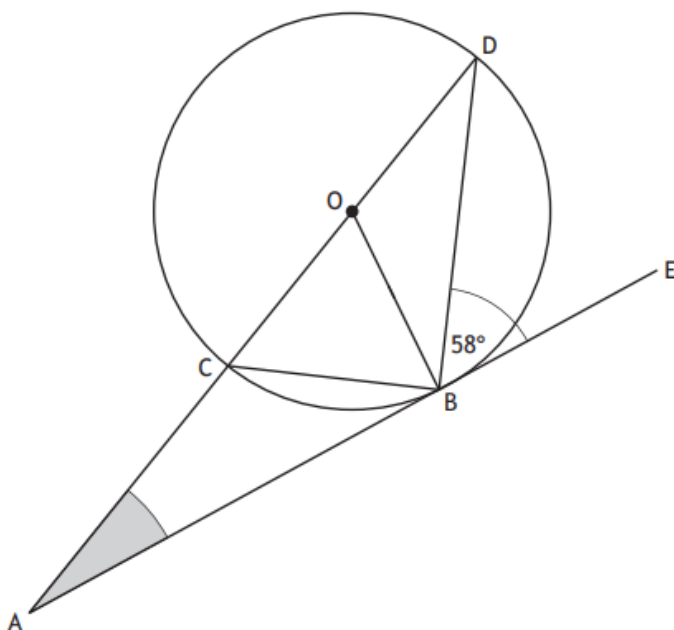


Calculate the volume of the carton.

Give your answer correct to 2 significant figures.

In the diagram shown below:

- ABE is a tangent to the circle centre O
- Angle DBE is 58°

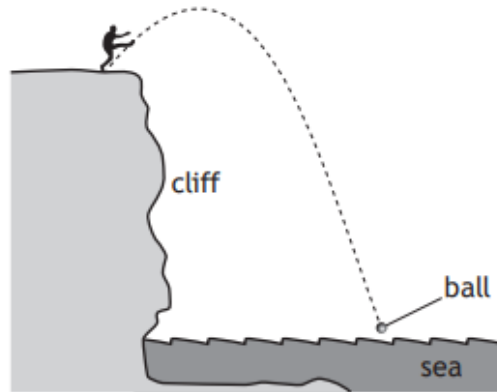


Calculate the size of angle CAB.

Interpreting a situation where mathematics can be used and identifying a strategy

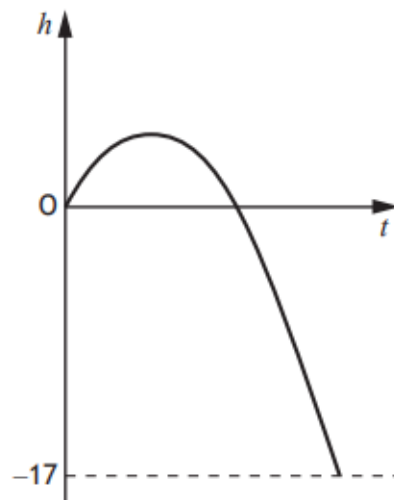
Grade A

A ball is kicked from a clifftop.



The height, h metres, of the ball relative to the clifftop after t seconds is given by $h = 12t - 5t^2$.

The graph below represents the height, h metres, of the ball relative to the clifftop after t seconds.



The sea is 17 metres below the clifftop.

(b) After how many seconds will the ball hit the sea?

Interpreting a situation where mathematics can be used and identifying a strategy

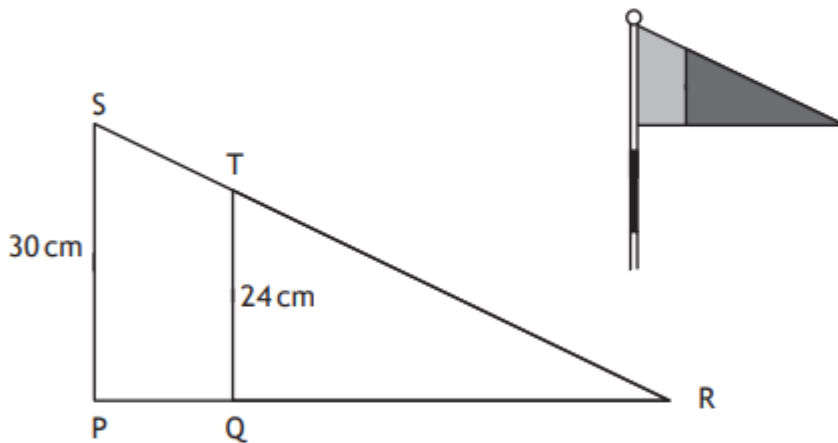
Grade A

The flag at each hole on a golf course is coloured red and blue.

The diagram below represents a flag.

Triangle QRT represents the red section.

PQTS represents the blue section.



Triangles PRS and QRT are mathematically similar.

The area of triangle QRT is 400 square centimetres.

Calculate the area of PQTS, the blue section of the flag.

Explaining a solution and relating it to context

Grade C

- ◆ part (b) of this question

Jack called his internet provider on six occasions to report connection problems.

On each occasion he noted the length of time he had to wait before speaking to an adviser.

The times (in minutes) were as follows:

13 16 10 22 5 12

- (a) Calculate the mean and standard deviation of these times.
- (b) Sophie also called the same internet provider, on several occasions, to report connection problems.
- Her mean waiting time was 15 minutes and the standard deviation was 4.3 minutes.
- Make two valid comments comparing Sophie's waiting times with Jack's waiting times.

- ◆ the communication mark of this question

Determine the nature of the roots of the function $f(x) = 2x^2 + 4x + 5$.

Explaining a solution and relating it to context

Grade A

A cinema sells popcorn in two different sized cartons.



The small carton is 16 centimetres deep and has a volume of 576 cubic centimetres.

The large carton is 24 centimetres deep and has a volume of 1125 cubic centimetres.

(a) Show that the two cartons are not mathematically similar.

Write the following in order of size starting with the smallest.

$$\cos 90^\circ \quad \cos 100^\circ \quad \cos 300^\circ$$

Justify your answer.

Question analysis

The following tables give an analysis of the question level for each question in the 2018 and 2019 past papers. Where a question contains marks at both grade C and grade A, the grade C marks are accessible to the candidate before the grade A marks.

2018 paper 1 — 50 marks

Question	Max mark	Question level	
		C	A
1	2	2	
2	3	3	
3	3	3	
4	2	2	
5	2	2	
6	2	2	
7	4	4	
8	2	2	
9	2	2	
10	3	3	
11	2	2	
12	1		1
13	2	2	
14	3		3
15	2		2
16	3	3	
17	3	3	
18	2		2
19	7	3	4

2018 paper 2 — 60 marks

Question	Max mark	Question level	
		C	A
1	3	3	
2	3	3	
3	2	2	
4	3	3	
5	6	6	
6	2	2	
7	3	3	
8	3	3	
9	3	3	
10	2		2
11	3	3	
12	4	2	2
13	4		4
14	2		2
15	3		3
16	4		4
17	5		5
18	5		5

2019 paper 1 — 50 marks

Question	Max mark	Question level	
		C	A
1	2	2	
2	2	2	
3	3	3	
4	3	3	
5a	3	3	
5b	2	2	
6a	3	3	
6b	1	1	
7	3	3	
8a	1	1	
8b	1	1	
8c	4	4	
9a	1	1	
9b i	1		1
9b ii	1		1
10a	1	1	
10b	2		2
11	3	3	
12	3		3
13	2		2
14	3		3
15a	1	1	
15b	4		4

2019 paper 2 — 60 marks

Question	Max mark	Question level	
		C	A
1	3	3	
2	2	2	
3	2	2	
4	2	2	
5	2	2	
6	3	3	
7	3	3	
8	5	5	
9	3	3	
10	2	2	
11	4	4	
12a	3	3	
12b	3		3
13	3		3
14	3	3	
15	3		3
16	3	1	2
17	2		2
18	4		4
19	5		5

Acknowledgements

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