

Suitable topics for an introductory task might be fitting a function to a set of data (fitting a quadratic function to data by use of 3×3 simultaneous equations) or establishing general terms in sequences. Use of a regression tool to find a curve of best fit will enhance portfolio modelling tasks. Whichever topic is chosen, it should be integrated into the course of study by being directly relevant to the work that the students are currently being taught, rather than remaining an isolated piece of mathematics.

Giving advice to students

After students have read through a task, they may have questions. They should be encouraged to seek answers to these questions by referring to examples of their own work or to any available textbooks and/or by discussing particular issues with their teacher or with other students. Students are not expected to work in complete isolation on a task. In particular, teachers should not try to reproduce examination conditions.

Some students may need extra encouragement to overcome initial difficulties and misunderstandings, and teachers need not feel inhibited in giving advice to students. If students ask specific questions, teachers should, where appropriate, guide them into productive routes of inquiry rather than provide a direct answer. If students do the mathematics themselves and write up their own findings unaided then the work can be considered to be the students' own.

Providing follow-up and feedback

Most tasks will require follow-up work to ensure that students have understood the purpose of them, especially when the task is being used to introduce a topic or to consolidate understanding. Time spent on this counts as normal class teaching time.

It is also necessary to provide feedback to students on the individual achievement levels awarded for each criterion so that they can take action to improve their future performance. It is therefore important that students are provided with copies of the assessment criteria and are informed of the way in which achievement levels are awarded. Suggested ways of providing feedback are described in the section on management of the portfolio in the *Mathematics SL guide*.

Ensuring that the work submitted is the student's own

Students need to be aware from the beginning that any portfolio work submitted for assessment must be entirely their own work. Certain safeguards will need to be in place to ensure that this is the case. Suggestions are included in the *Mathematics SL guide*, in the section on guidance and authenticity in the internal assessment details.

Students may have easy access to information contained on the Internet, CD-Roms and other such sources. Although it may be very tempting for them to use a "cut and paste" technique, it should be made clear that this practice is unacceptable, unless the author is acknowledged and details of the source are provided.

Students may also wish to consult experts outside the school. While they should not be discouraged from seeking to expand their knowledge, students should be made aware of the extent to which they can obtain help from outside sources. Generally speaking, talking through a task and discussing related mathematical concepts is acceptable. However, it is not acceptable for students to receive written information on specific areas of a task or to have any part of the work completed for them.

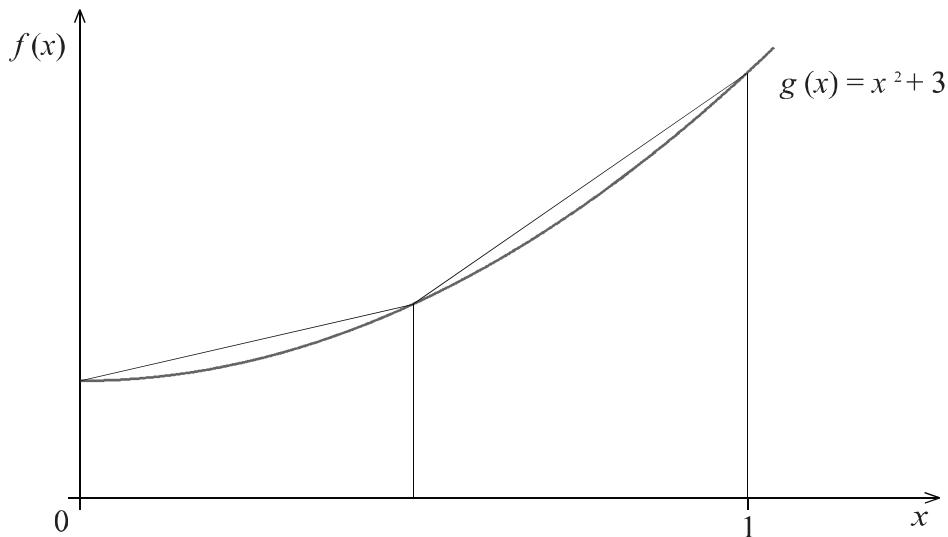
SHADY AREAS

SL TYPE I

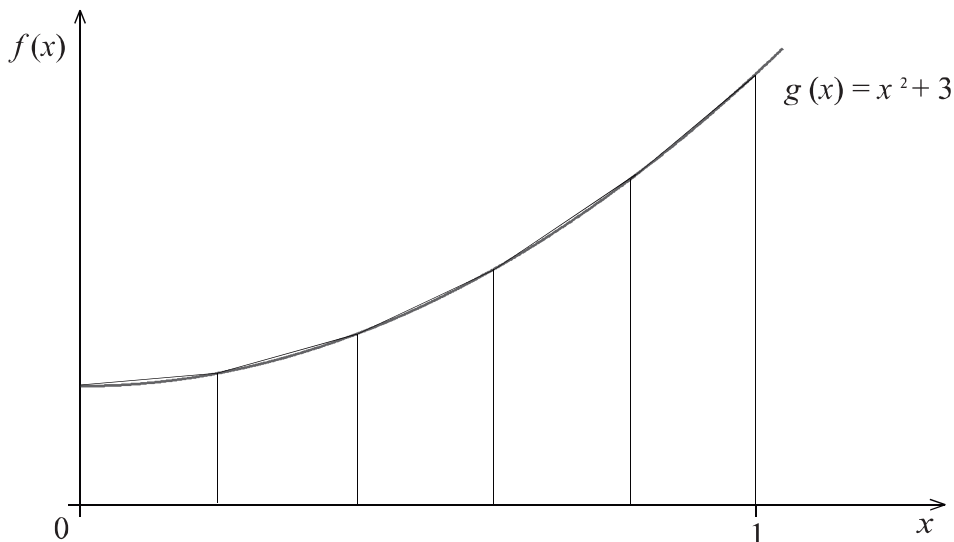
In this investigation you will attempt to find a rule to approximate the area under a curve (*i.e.* between the curve and the x -axis) using trapeziums (trapezoids).

Consider the function $g(x) = x^2 + 3$.

The diagram below shows the graph of g . The area under this curve from $x = 0$ to $x = 1$ is approximated by the sum of the area of two trapeziums. Find this approximation.



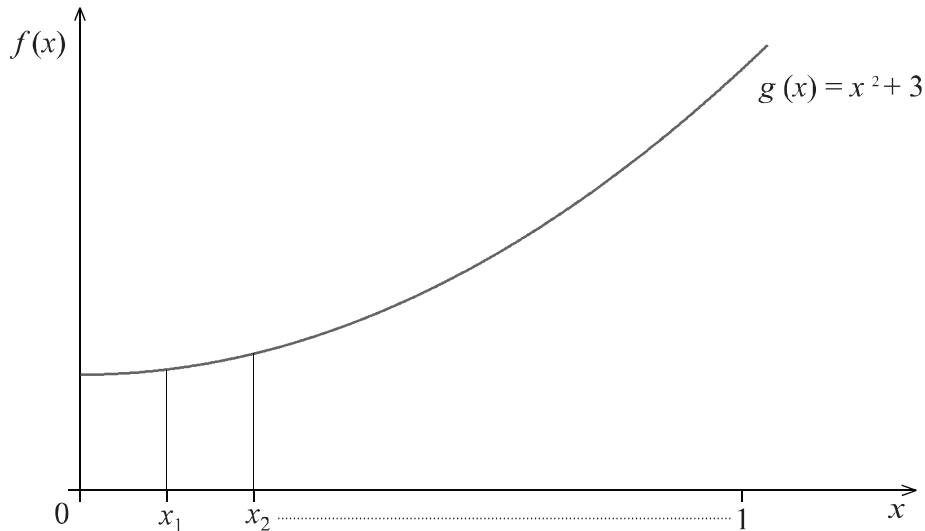
Increase the number of trapeziums to five and find a second approximation for the area.



With the help of technology, create diagrams showing an increasing number of trapeziums. For each diagram, find the approximation for the area. What do you notice?

(This task continues on the following page)

Use the diagram below to find a general expression for the area under the curve of g , from $x = 0$ to $x = 1$, using n trapeziums.



Use your results to develop **the** general statement that will estimate the area under any curve $y = f(x)$ from $x = a$ to $x = b$ using n trapeziums. Show clearly how you developed your statement.

Consider the areas under the following three curves, from $x = 1$ to $x = 3$.

$$y_1 = \left(\frac{x}{2}\right)^{\frac{2}{3}}$$

$$y_2 = \frac{9x}{\sqrt{x^3 + 9}}$$

$$y_3 = 4x^3 - 23x^2 + 40x - 18$$

Use your general statement, with eight trapeziums, to find approximations for these areas.

Find $\int_1^3 \left(\frac{x}{2}\right)^{\frac{2}{3}} dx$, $\int_1^3 \left(\frac{9x}{\sqrt{x^3 + 9}}\right) dx$, $\int_1^3 (4x^3 - 23x^2 + 40x - 18) dx$, and compare these answers with your approximations. Comment on the accuracy of your approximations.

Use other functions to explore the scope and limitations of your general statement. Does it always work? Discuss how the shape of a graph influences your approximation.

Overview of assessment criteria for type I tasks

	Criterion A: Use of notation and terminology	Criterion B: Communication	Criterion C: Mathematical process — searching for patterns	Criterion D: Results — generalization	Criterion E: Use of technology	Criterion F: Quality of work
0	The student does not use appropriate notation and terminology.	The student neither provides explanations nor uses appropriate forms of representation (for example, symbols, tables, graphs and/or diagrams).	The student does not attempt to use a mathematical strategy.	The student does not produce any general statements consistent with the patterns and/or structures generated.	The student uses a calculator or computer for only routine calculations.	The student has shown a poor quality of work.
1	The student uses some appropriate notation and/or terminology.	The student attempts to provide explanations or uses some appropriate forms of representation (for example, symbols, tables, graphs and/or diagrams).	The student uses a mathematical strategy to produce data.	The student attempts to produce a general statement that is consistent with the patterns and/or structures generated.	The student attempts to use a calculator or computer in a manner that could enhance the development of the task.	The student has shown a satisfactory quality of work.
2	The student uses appropriate notation and terminology in a consistent manner and does so throughout the work.	The student provides adequate explanations or arguments, and communicates them using appropriate forms of representation (for example, symbols, tables, graphs and/or diagrams).	The student organizes the data generated.	The student correctly produces a general statement that is consistent with the patterns and/or structures generated.	The student makes limited use of a calculator or computer in a manner that enhances the development of the task.	The student has shown an outstanding quality of work.
3	The student provides complete, coherent explanations or arguments, and communicates them clearly using appropriate forms of representation (for example, symbols, tables, graphs and/or diagrams).	The student successfully explains or argues, and communicates them clearly using appropriate forms of representation (for example, symbols, tables, graphs and/or diagrams).	The student attempts to analyse data to enable the formulation of a general statement.	The student expresses the correct general statement in appropriate mathematical terminology .	The student makes full and resourceful use of a calculator or computer in a manner that significantly enhances the development of the task.	
4		The student successfully analyses the correct data to enable the formulation of a general statement.	The student successfully enable the formulation of a general statement.	The student correctly states the scope or limitations of the general statement.		
5		The student tests the validity of the general statement by considering further examples.	The student tests the validity of the general statement by considering further examples.	The student gives a correct , informal justification of the general statement.		

BODY MASS INDEX**SL TYPE II**

Body mass index (BMI) is a measure of one's body fat. It is calculated by taking one's weight (kg) and dividing by the square of one's height (m).

The table below gives the median BMI for females of different ages in the US in the year 2000.

Age (yrs)	BMI
2	16.40
3	15.70
4	15.30
5	15.20
6	15.21
7	15.40
8	15.80
9	16.30
10	16.80
11	17.50
12	18.18
13	18.70
14	19.36
15	19.88
16	20.40
17	20.85
18	21.22
19	21.60
20	21.65

(Source: <http://www.cdc.gov>)

Using technology, plot the data points on a graph. Define all variables used and state any parameters clearly.

What type of function models the behaviour of the graph? Explain why you chose this function. Create an equation (a model) that fits the graph.

On a new set of axes, draw your model function and the original graph. Comment on any differences. Refine your model if necessary.

Use technology to find another function that models the data. On a new set of axes, draw your model function and the function you found using technology. Comment on any differences.

Use your model to estimate the BMI of a 30-year-old woman in the US. Discuss the reasonableness of your answer.

Use the Internet to find BMI data for females from another country. Does your model also fit this data? If not, what changes would you need to make? Discuss any limitations to your model.

Overview of assessment criteria for type II tasks

	Criterion A: Use of notation and terminology	Criterion B: Communication	Criterion C: Mathematical process — developing a model	Criterion D: Results — interpretation	Criterion E: Use of technology	Criterion F: Quality of work
0	The student does not use appropriate notation and terminology.	The student neither provides explanations nor uses appropriate forms of representation (for example, symbols, tables, graphs and/or diagrams).	The student does not define variables, parameters or constraints of the task.	The student has not arrived at any results.	The student uses a calculator or computer for only routine calculations.	The student has shown a poor quality of work.
1	The student uses some appropriate notation and/or terminology.	The student attempts to provide explanations or uses some appropriate forms of representation (for example, symbols, tables, graphs and/or diagrams).	The student defines some variables, parameters or constraints of the task.	The student has arrived at some results.	The student attempts to use a calculator or computer in a manner that could enhance the development of the task.	The student has shown a satisfactory quality of work.
2	The student uses appropriate notation and terminology in a consistent manner and does so throughout the work.	The student provides adequate explanations or arguments, and communicates them using appropriate forms of representation (for example, symbols, tables, graphs and/or diagrams).	The student defines variables, parameters and constraints of the task and attempts to create a model.	The student has not interpreted the reasonableness of the results of the model in the context of the task .	The student makes limited use of a calculator or computer in a manner that enhances the development of the task.	The student has shown an outstanding quality of work.
3	The student provides complete, coherent explanations or arguments, and communicates them clearly using appropriate forms of representation (for example, symbols, tables, graphs and/or diagrams).	The student provides coherent explanations or arguments, and communicates them clearly using appropriate forms of representation (for example, symbols, tables, graphs and/or diagrams).	The student correctly analyses variables, parameters and constraints of the task to enable the formulation of a mathematical model that is relevant to the task and consistent with the level of the course.	The student has attempted to interpret the reasonableness of the results of the model in the context of the task , to the appropriate degree of accuracy.	The student makes full and resourceful use of a calculator or computer in a manner that significantly enhances the development of the task.	
4		The student considers how well the model fits the data.		The student has correctly interpreted the reasonableness of the results of the model in the context of the task, to the appropriate degree of accuracy.		
5		The student applies the model to other situations.		The student has correctly and critically interpreted the reasonableness of the results of the model in the context of the task, including possible limitations and modifications of these results, to the appropriate degree of accuracy.		