

Test 1 - revision questions [61 marks]

1. [Maximum mark: 18]

SPM.2.AHL.TZ0.3

In this question, give all answers to two decimal places.

Bryan decides to purchase a new car with a price of €14 000, but cannot afford the full amount. The car dealership offers two options to finance a loan.

Finance option A:

A 6 year loan at a nominal annual interest rate of 14 % **compounded quarterly**. No deposit required and repayments are made each quarter.

(a.i) Find the repayment made each quarter. [3]

(a.ii) Find the total amount paid for the car. [2]

(a.iii) Find the interest paid on the loan. [2]

Finance option B:

A 6 year loan at a nominal annual interest rate of r % **compounded monthly**. Terms of the loan require a 10 % deposit and monthly repayments of €250.

(b.i) Find the amount to be borrowed for this option. [2]

(b.ii) Find the annual interest rate, r . [3]

(c) State which option Bryan should choose. Justify your answer. [2]

(d) Bryan chooses option B. The car dealership invests the money Bryan pays as soon as they receive it.

If they invest it in an account paying 0.4 % interest per month and inflation is 0.1 % per month, calculate the real amount of money the car dealership has received by the end of the 6 year period. [4]

2. [Maximum mark: 15]

EXM.2.SL.TZ0.2

Sophie is planning to buy a house. She needs to take out a mortgage for \$120000. She is considering two possible options.

Option 1: Repay the mortgage over 20 years, at an annual interest rate of 5%, compounded annually.

Option 2: Pay \$1000 every month, at an annual interest rate of 6%, compounded annually, until the loan is fully repaid.

(a.i) Calculate the monthly repayment using option 1. [2]

(a.ii) Calculate the total amount Sophie would pay, using option 1. [2]

(b.i) Calculate the number of months it will take to repay the mortgage using option 2. [3]

(b.ii) Calculate the total amount Sophie would pay, using option 2. [2]

Give a reason why Sophie might choose

(c.i) option 1. [1]

(c.ii) option 2. [1]

Sophie decides to choose option 1. At the end of 10 years, the interest rate is changed to 7%, compounded annually.

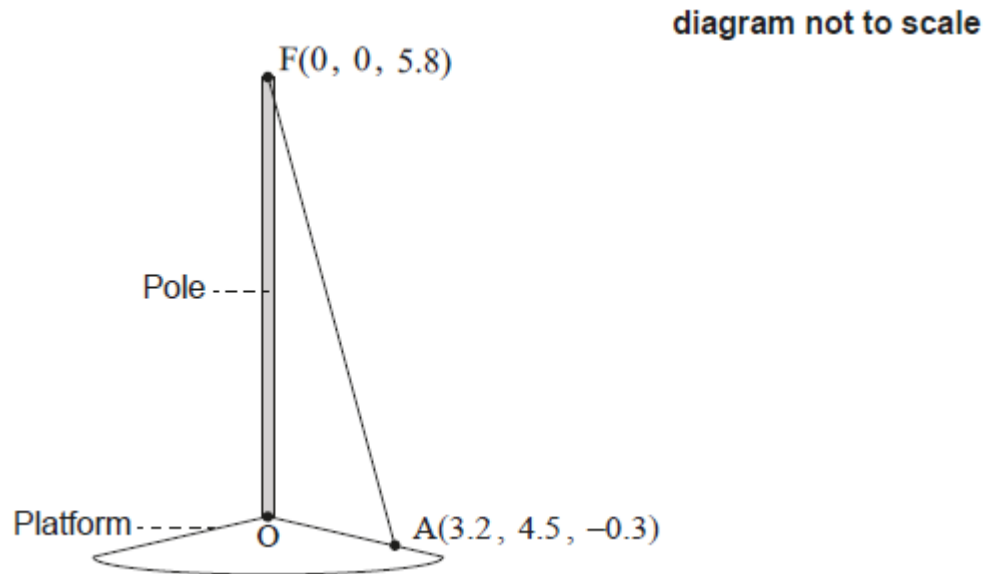
(d.i) Use your answer to part (a)(i) to calculate the amount remaining on her mortgage after the first 10 years. [2]

(d.ii) Hence calculate her monthly repayment for the final 10 years. [2]

3. [Maximum mark: 8]

22M.1.AHL.TZ1.6

A vertical pole stands on a sloped platform. The bottom of the pole is used as the origin, O , of a coordinate system in which the top, F , of the pole has coordinates $(0, 0, 5.8)$. All units are in metres.



The pole is held in place by ropes attached at F .

One of these ropes is attached to the platform at point $A(3.2, 4.5, -0.3)$.
The rope forms a straight line from A to F .

- (a) Find \overrightarrow{AF} . [1]
- (b) Find the length of the rope. [2]
- (c) Find \hat{FAO} , the angle the rope makes with the platform. [5]

4. [Maximum mark: 4]

21M.1.SL.TZ1.1

Katya approximates π , correct to four decimal places, by using the following expression.

$$3 + \frac{1}{6 + \frac{13}{16}}$$

(a) Calculate Katya's approximation of π , correct to four decimal places. [2]

(b) Calculate the percentage error in using Katya's four decimal place approximation of π , compared to the exact value of π in your calculator. [2]

5. [Maximum mark: 6]

21M.1.SL.TZ2.10

Tommaso and Pietro have each been given 1500 euro to save for college.

Pietro invests his money in an account that pays a nominal annual interest rate of 2.75%, **compounded half-yearly**.

(a) Calculate the amount Pietro will have in his account after 5 years. Give your answer correct to 2 decimal places. [3]

(b) Tommaso wants to invest his money in an account such that his investment will increase to 1.5 times the initial amount in 5 years. Assume the account pays a nominal annual interest of $r\%$ **compounded quarterly**.

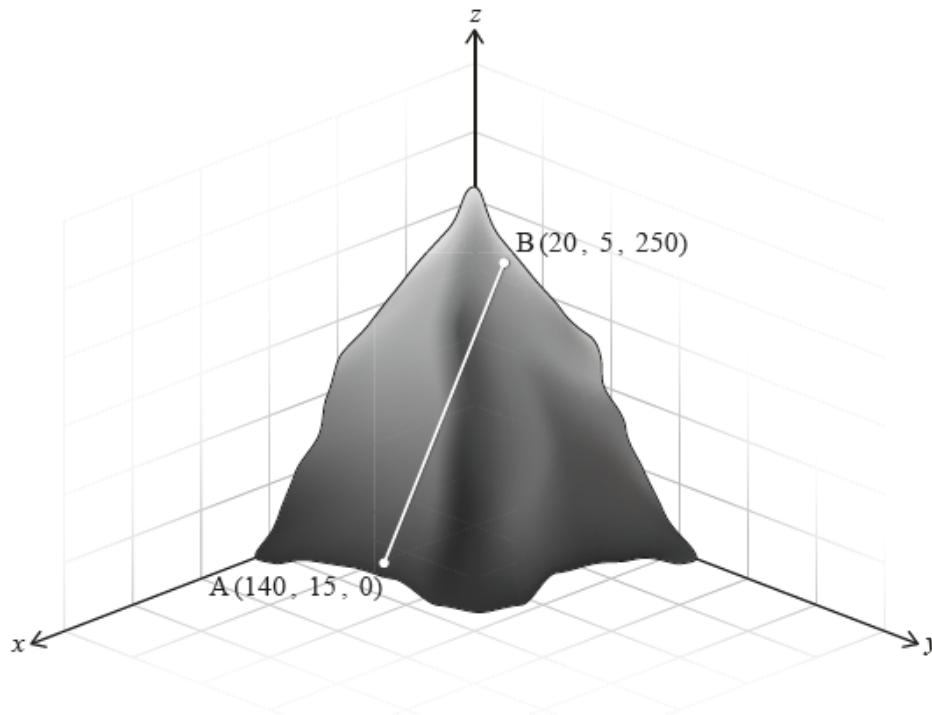
Determine the value of r . [3]

6. [Maximum mark: 5]

21M.1.SL.TZ2.2

An inclined railway travels along a straight track on a steep hill, as shown in the diagram.

diagram not to scale



The locations of the stations on the railway can be described by coordinates in reference to x , y , and z -axes, where the x and y axes are in the horizontal plane and the z -axis is vertical.

The ground level station A has coordinates $(140, 15, 0)$ and station B, located near the top of the hill, has coordinates $(20, 5, 250)$. All coordinates are given in metres.

(a) Find the distance between stations A and B. [2]

Station M is to be built halfway between stations A and B.

(b) Find the coordinates of station M. [2]

(c) Write down the height of station M, in metres, above the ground.

[1]

7. [Maximum mark: 5]

21M.1.AHL.TZ2.5

Roger buys a new laptop for himself at a cost of £495. At the same time, he buys his daughter Chloe a higher specification laptop at a cost of £2200.

It is anticipated that Roger's laptop will depreciate at a rate of 10% per year, whereas Chloe's laptop will depreciate at a rate of 15% per year.

(a) Estimate the value of Roger's laptop after 5 years. [2]

Roger and Chloe's laptops will have the same value k years after they were purchased.

(b) Find the value of k . [2]

(c) Comment on the validity of your answer to part (b). [1]