MATHEMATICS QUESTIONS BY TOPICS

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FINANCIAL MATHEMATICS

20 Extended Answer Questions with curriculum references and detailed answers

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Student Book

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Read instructions

Mathematics Questions by Topics
Financial Mathematics - Extended Answer

Index – Click on the question.

Creator: William Paul Healy
Title: Mathematics Questions by Topics – Financial Mathematics - 20 Extended Answer Questions
ISBN: 9781922881090 (eBook)
Series: Mathematics Questions by Topics
Target Audience: School age. Secondary.
Subjects: Mathematics
Other Creators: Barbara Clarice Healy, Vivienne Bond

About the Authors: William Paul Healy BSc BA Dip Ed and Barbara Clarice Healy BSc BEd are experienced mathematics and science teachers each with more than 30 years classroom experience. As principal writers for Kilbaha Education they bring a wealth of pedagogical knowledge and expertise to their many publications. The quality of their work has been demonstrated over the years with content written for the VCE examinations in Victoria Australia.

Index

Financial Mathematics - Extended Answer Question 1 Source: K21FM2Q5

Question 1 (7 marks)

Jeff runs a business in which he does the final stitching on quilts with a quilting machine. Jeff chooses the reducing balance method to calculate the depreciation on his new quilting machine.
The value of the quilting machine, in dollars, after n years, Q_n can be modelled by the recurrence relation:

$$Q_0 = 27000, \qquad Q_{n+1} = 0.91Q_n$$

a. What amount, in dollars, did Jeff pay for the new machine?

1 mark

b. Show, with recursion, that the value of the machine after 2 years is $22358.70 by filling in the boxes below with the appropriate values.

2 marks

$Q_0 =$ 27000

$Q_1 =$ ☐ x 27000 = ☐

$Q_2 =$ ☐ x ☐ = ☐

c. What is the annual percentage rate of depreciation used by Jeff?

1 mark

Financial Mathematics - Extended Answer Question 1 Source: K21FM2Q5

Question 1 (continued)

d. After how many years will the value of Jeff's quilting machine first fall below $12000?

1 mark

A rule of the form $Q_n = a \times b^n$ can be used to determine the value, in dollars, of the quilting machine, Q_n, after n years.

e. Write down this rule for Q_n.

1 mark

Jeff claims the machine's depreciation as a tax deduction each year.

f. By how much does the machine depreciate during the fourth year?
Give your answer to the nearest whole dollar.

1 mark

END OF QUESTION 1

Index

Financial Mathematics - Extended Answer Question 1 Source: K21FM2Q5

Curriculum	Subject	Topic	Description
Australia	General Mathematics Unit 3	Geometric sequence	Use recursion to generate a geometric sequence (ACMGM071) Deduce a rule for the nth term of a particular geometric sequence from the pattern of the sequence and use this rule to make predictions (ACMGM073)
Victoria	General Mathematics Unit 2	Recursion and financial arithmetic	The concept of geometric sequence as a function and its recursive specification
New South Wales	Mathematics Advanced Stage 6	Geometric sequences and series	Recognise and use the recursive definition of a geometric sequence: $Tn=rTn-1$, $T_1=a$

Curriculum	Subject	Topic	Description
Australia	General Mathematics Unit 4	Loans, investment, annuities	With the aid of a calculator or computer based financial software, solve problems involving compound interest loans or investments; for example, determining the future value of a loan, the number of compounding periods for an investment to exceed a given value, the interest rate needed for an investment to exceed a given value. (ACMGM096)
Victoria	General Mathematics Unit 3,4	Compound interest investment	Use of technology with financial modelling functionality to solve problems involving annuity investments, including determining the future value of an investment after a number of compounding periods, the number of compounding periods for the investment to exceed a given value and the interest rate or payment amount needed for an investment to exceed a given value in a given time.
New South Wales	Mathematics Advanced Stage 6	Financial Mathematics	Use an online calculator to investigate the effect of the interest rate, the repayment amount or the making of an additional lump-sum payment, on the time taken to repay a loan

End of
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Answers to 20 Extended Answer Questions

- Click here for the answer index
- Check your answer
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Index – Click on the answer. ACR = Australian curriculum Reference

Index

Mathematics Questions by Topics
Financial Mathematics - Extended Answer

Source: K21FM2S5

Question 1 (7 marks)

a. **$27000** (1 mark)	**b.** $Q_1 = \mathbf{0.91}\times 27000 = \mathbf{24570}$ $Q_2 = \mathbf{0.91}\times\mathbf{24570} = \mathbf{22358.70}$ (2 marks)
c. 100 – 91 **= 9%** (1 mark)	**d. 9 years** By continuing to multiply by 0.91, we get $Q_8 = 12696.8$ ... $Q_9 = 11554.1$ ... Alternatively, solving the equation $27000\times 0.91^n \leq 12000$ gives $n \geq 8.5984$ ... Now in this problem, *n* takes integral values, so *n* = 9. (1 mark)
e. $\boldsymbol{Q_n = 27000\times 0.91^n}$ (1 mark)	**f. $1831** $Q_3 = 20346.417$ ... During the fourth year, the machine will depreciate by 9% of 20346.417… i.e. $1831 to the nearest dollar. (1 mark)

END OF ANSWERS TO QUESTION 1

Index

Mathematics Questions by Topics
Financial Mathematics - Extended Answer

Source: K15FM2S3

Question 20 (4 marks)

a. Use TVM solver $N = 18 \times 12$ $I = 5.2$ $PV = 332000$ $PMT =$ $FV = 0$ $P/Y = 12$ $C/Y = 12$ This gives $PMT = \$2370$ (1 mark)	**b.** Use TVM solver $N = 60$ $I = 5.2$ $PV = 332000$ $PMT = -2370.0769$ $FV =$ $P/Y = 12$ $C/Y = 12$ This gives $FV = \$268334$ Amount owing = 268334 – 150000 = $118,334 (1 mark)
c. Use TVM solver $N =$ $I = 5.2$ $PV = 118334$ $PMT = -1916$ $FV = 0$ $P/Y = 12$ $C/Y = 12$ This gives $N = 72$ 72 months = 6 years. (1 mark)	**d.** Actual time of repayment will be a little over 72 months. Use TVM solver $N = 72$ $I = 5.2$ $PV = 118334$ $PMT = -1916$ $FV =$ $P/Y = 12$ $C/Y = 12$ This gives $FV = -63.93631138$ Use TVM solver $N = 1$ $I = 5.2$ $PV = 63.93631138$ $PMT =$ $FV = 0$ $P/Y = 12$ $C/Y = 12$ This gives $FV = \$64.22$ (1 mark)

END OF ANSWERS TO QUESTION 20

Index

End of
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Index

Financial Mathematics - Extended Answer Question 2 Source: K21FM2Q6

Question 2 (3 marks)

Jeff buys a second quilting machine. The initial value of this machine is $36000.
He decides to depreciate the machine using the unit cost method.
The machine quilts 340 pieces each year.
After five years, the value of the machine is $20700.

a. **Show** that the machine depreciates by $9 for every piece it quilts.

1 mark

b. Let V_n be the value of the machine after n years.

Write down a recurrence relation, in terms of V_0, V_{n+1} and V_n that could be used to model the value of the machine using this unit cost depreciation method.

1 mark

c. The value of the machine continues to depreciate by $9 for every piece quilted.
The machine has a scrap value of $1962.
After how many pieces quilted will the machine reach its scrap value? 1 mark

END OF QUESTION 2

