



3.8H Percentage Change: Higher Tier Practice

EDEXCEL Edexcel 1MA1 · Calculator allowed · about 70 minutes

Total Marks

Name: _____ Date: ____ / ____ / ____

Answer ALL questions. Show all your working.

- 1** A jacket costs 85 pounds. It is reduced by 15% in a sale. Work out the sale price of the jacket to the nearest penny.

(Total for Question 1 is 2 marks)

- 2** A TV is sold with 20% discount and then a further 10% off the reduced price. The original price was 450 pounds.
Work out the final selling price. Give your answer to the nearest penny.

(Total for Question 2 is 3 marks)

- 3** A smartphone price increases from 320 pounds to 400 pounds.
Work out the percentage increase. Give your answer correct to 1 decimal place.

(Total for Question 3 is 3 marks)

- 4** A car's value is depreciated by 12% each year. Its current value is 16,200 pounds.
Work out the value of the car after 2 years. Give your answer to the nearest pound.

(Total for Question 4 is 4 marks)

- 5** A shop shows an item with price 48 pounds including 20% VAT. Work out the price of the item before VAT. Give your answer to the nearest penny.

(Total for Question 5 is 5 marks)

- 6** A population increases by 8% each year for 3 years and then decreases by 5% in the fourth year.
Starting population = 12 500.
Work out the population after the 4 years. Give your answer to the nearest whole number.

(Total for Question 6 is 6 marks)

- 7 The price of a commodity first increases by $p\%$ then decreases by $q\%$ and ends up at the same price as it started.

Show that to first order (neglecting the small product term $pq/100$), q approximately equals p .

You must show the algebraic steps leading to the approximation.

(Total for Question 7 is 7 marks)

- 8 A fund grows by 6% per year compounded annually. Show that after n years the amount is $A = P(1.06)^n$.

Then find how many whole years are needed for the fund to at least double if $P = 8000$. Give your answer as an integer number of years.

(a) Show that after n years the amount is $A = P(1.06)^n$. (3)

(b) Find the smallest whole number n such that $A \geq 2P$ when $P = 8000$. (5)

(Total for Question 8 is 8 marks)

9 A machine is sold after 4 years. Its value follows $V = 60\,000 \times (0.74)^t$, where t is the age in years.

(a) Work out the value after 4 years. (3 marks)

(b) The owner expects the value to be at least 20 000 pounds. Use the formula to show whether this expectation is met after 6 years. Give a brief justification with your answer. (4 marks)

(c) Find the age t when the value will first fall below 25 000 pounds. Give your answer to 1 decimal place. (5 marks)

(a) Work out the value after 4 years. (3)

(b) Use the formula to show whether value after 6 years is at least 20 000 pounds. (4)
Give a brief justification.

(c) Find t when V first falls below 25 000 pounds. Give answer to 1 decimal place. (5)

(Total for Question 9 is 12 marks)

Mark scheme · 3.8H Percentage Change: Higher Tier Practice

Question 1

- **M1** calculate 15% of 85 or apply 85×0.85 method
- **A1** 72.25 pounds cao
- **Answer: 72.25**

Question 2

- **M1** apply first reduction: $450 \times 0.80 = 360$ or show method
- **M1** apply second reduction: $360 \times 0.90 = 324$ or equivalent
- **A1** 324.00 pounds cao
- **Answer: 324.00**

Question 3

- **M1** calculate change $400 - 320 = 80$ and form $80/320$
- **M1** evaluate $80/320 = 0.25$ and convert to percent
- **A1** 25.0% cao
- **Answer: 25.0**

Question 4

- **M1** use factor 0.88 for one year and show one step
- **M1** apply factor twice: $16200 \times 0.88 \times 0.88$ or 16200×0.88^2
- **A1** 12545.28 to 2 d.p. (intermediate) ft
- **A1** 12545 pounds (nearest pound) cao
- **Answer: 12545**

Question 5

- **M1** identify that 48 is 120% of the pre-VAT price or use reverse percentage
- **M1** set up $48 = 1.20 \times \text{original}$ and divide: $\text{original} = 48 / 1.20$
- **M1** calculate $48 / 1.20 = 40.0$
- **A1** 40.00 pounds cao
- **B1** state check: $40 \times 1.20 = 48$ oe
- **Answer: 40.00**

Question 6

- **M1** use growth factor 1.08 for each of first 3 years
- **M1** use decrease factor 0.95 for year 4
- **M1** combine factors: $12500 \times 1.08^3 \times 0.95$
- **M1** evaluate $1.08^3 = 1.259712$ (or equivalent) and multiply through
- **A1** 14959.08 (intermediate) ft
- **A1** 14959 people (nearest whole number) cao
- **Answer: 14959**

Question 7

- **M1** state final price = initial $\times (1 + p/100) \times (1 - q/100)$
- **M1** set $(1 + p/100)(1 - q/100) = 1$ since final = initial
- **M1** expand: $1 + p/100 - q/100 - (pq)/10000 = 1$
- **M1** cancel 1 and rearrange to $p/100 - q/100 - (pq)/10000 = 0$
- **M1** rearrange to $q/100 = p/100 - (pq)/10000$
- **M1** neglect $(pq)/10000$ as small to get $q/100 \approx p/100$
- **A1** conclude $q \approx p$ with brief justification cao
- **Answer: q approx= p**

Question 8

- (a) **M1** state amount after 1 year = $P(1 + 0.06)$, after 2 years = $P(1.06)^2$
- (a) **M1** state pattern and generalise for n years
- (a) **A1** $A = P(1.06)^n$ cao
- (a) **Answer: $A = P(1.06)^n$**
- (b) **M1** set up $(1.06)^n \geq 2$
- (b) **M1** take logs or use growth table / calculator to solve $n \geq \ln 2 / \ln 1.06$
- (b) **M1** calculate $\ln 2 / \ln 1.06 = \text{approx } 11.897...$ (or use $\log_{10}$ equivalent)
- (b) **A1** state n must be integer ≥ 11.897
- (b) **A1** $n = 12$ years cao
- (b) **Answer: 12**

Question 9

- (a) **M1** substitute $t = 4$: 60000×0.74^4 shown
- (a) **M1** evaluate $0.74^4 = 0.299865...$ or equivalent
- (a) **A1** 17991.95 to 2 d.p. (nearest penny) cao
- (a) **Answer: 17991.95**
- (b) **M1** substitute $t = 6$: 60000×0.74^6 shown
- (b) **M1** evaluate $0.74^6 \text{ approx} = 0.1642$ (or equivalent) and multiply
- (b) **M1** calculate value $\text{approx} = 9852.4$ (or approx 9852) and compare with 20000
- (b) **A1** conclude value < 20000 and expectation not met cao
- (b) **Answer: No; value approx = 9852 (< 20000)**
- (c) **M1** set up inequality $60000 \times 0.74^t < 25000$
- (c) **M1** rearrange: $0.74^t < 25000/60000 = 5/12$
- (c) **M1** take logs: $t \ln 0.74 < \ln(5/12)$ and solve for t
- (c) **A1** compute $t > \ln(5/12)/\ln(0.74) \text{ approx} = 2.91...$ and choose first t where value falls below
- (c) **A1** $t = 2.9$ years (1 d.p.) cao
- (c) **Answer: 2.9**