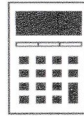# GCSE MATHEMATICS

Finance
Including percentages and interest

AQA These questions have been taken or modified from previous AQA GCSE Mathematics Papers.

Instructions
- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Answer all questions.
- You must answer the questions in the spaces provided.
- If your calculator does not have a π button, take the value of π to be 3.14 unless another value is given in the question.

Information
- The marks for questions are shown in brackets.
- The quality of your written communication is specifically assessed in questions that are indicated with an asterisk (*).

Advice
- Read each question carefully before you start to answer it.
- In all calculations, show clearly how you work out your answer.
- Use the number of marks for the question as a guide to the amount of time you need to spend.
- Look at previous parts of the question, e.g. a), b), c) i) as there may be information there you need to answer later parts.
- Check your answer is realistic and appropriate.
- For calculator decimal numbers always write your full calculator display in the working out area and then, if you need to, round the answer on the answer line.

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1 You want a loan of £5000.
Here are two offers.

Bank A	Bank B
£5000 loan	£5000 loan
Pay £158 per month for 3 years	Pay monthly for 5 years Total interest added: £1120

1 (a) For Bank A, work out the total amount you have to pay.

$158 \times 3 \times 12$

Answer £ 5688 *(2 marks)*

1 (b) For Bank B, work out the amount you pay per month.

$5 \times 12 = 60$ $\dfrac{5000 + 1120}{60}$

102

Answer £ 102 *(3 marks)*

1 (c) Choose a bank for your loan.
Give a reason for your choice.

Bank   A

Reason   You Pay Less Overall / Lower Total Amout

(1 mark)

or

Bank B
Lower monthly Payment.

2 Mel bought a house for £142 000 in April 2002.
She sold it for £176 000 in April 2009.

Here is a formula to work out annual appreciation.

$$\text{Annual appreciation} = \frac{\text{Final price} - \text{Original price}}{\text{Number of years}}$$

Work out the annual appreciation of Mel's house.
Give your answer to the nearest £5.

$$\frac{176000 - 142000}{2009 - 2002} = 4857.1428$$

Answer £ _____ 4855 _____ (3 marks)

*3 Mr Walker receives his gas bill every three months.
He pays £45 to the gas company each month.

The first 350 units of gas on each bill cost 7.2 pence per unit.
The rest of the units cost 4 pence per unit.

Mr Walker gets a credit of £41.64 for money he has overpaid in the last three-month period.

How many units of gas were used?

Mr Walker Paid $3 \times 45 = £135$

First 350 units $350 \times 0.072 = £25.20$
Rest $= x \times 0.04 = 0.04x$
$135 - 41.64 = £93.36$
Gas cost $= £93.36$
$25.20 + 0.04x = 93.36$
$0.04x = 68.16 = 1704$ $1704 + 350 = 2054$

Answer _____ 2054 _____ units   (6 marks)

*4 Customers at a shop who spend £100 or more can pay by these methods.

A	12 payments	Each payment is 10% of the cost price
B	24 payments	Each payment is 6% of the cost price
C	36 payments	Each payment is 4% of the cost price

Which method is the cheapest?
You **must** show your working.

$10\% \text{ of } 100 = 10 \times 12 = £120$
$6\% \text{ of } 100 = 6 \times 24 = £144$
$4\% \text{ of } 100 = 4 \times 36 = £144$

Answer _____ Method 1 _____ (3 marks)

5 (a) In year 1, the value of a watch increases by 12%
In year 2, the value increases by the same **amount of money** as in year 1

The owner wants to work out the value of the watch at the end of year 2

Which multiplier can be used with the original value to work this out?
Circle your answer.

[1 mark]

1.12   (1.24) 1.12^2 1.24^2

5 (b) In year 1, the value of a car decreases by 12%
In year 2, the value decreases by 12% of the value at the end of year 1

The owner wants to work out the value of the car at the end of year 2

Which multiplier can be used with the original value to work this out?
Circle your answer.

[1 mark]

0.76   0.88 0.76^2 (0.88^2)

6 A box of mixed grass seed contains Rye seed and Fescue seed in the ratio

Rye : Fescue = 1 : 3

6 (a) Rye seed is £3.80 per kg.
Fescue seed is £5.20 per kg.

Work out the cost of a 5 kg box of mixed grass seed.

$3 \times 5.20 = £15.60$

$3.80 : 15.60$

$15.60 + 3.80 = 19.40$

But this is only 4kg

$19.40 \times 5/4 = 24.25$

Answer £ ....24.25........ (5 marks)

6 (b) VAT is charged at 20%.
A large box of grass seed costs £5.64 including VAT.
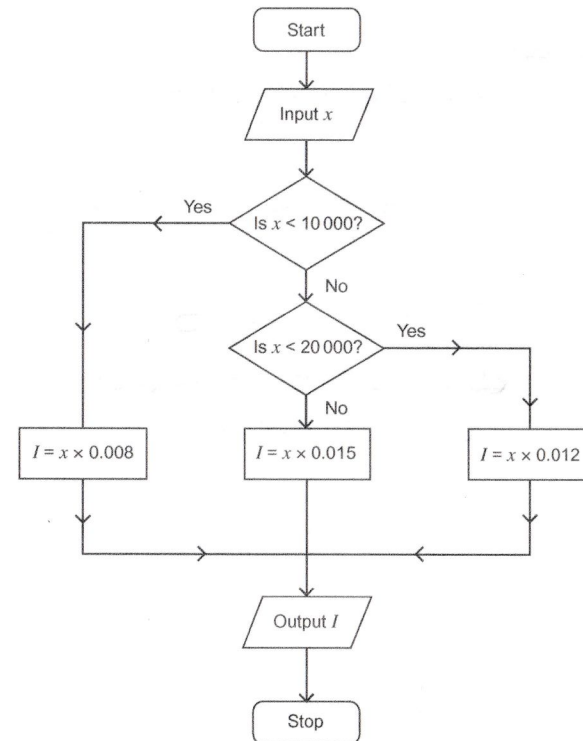
What was the cost before VAT was added?

$100 + 20\%$ of cost $= 5.64$

120% of $x = 5.64$

$1.2x = 5.64$

$x = \frac{5.64}{1.2}$

Answer £ ....4.70........ (3 marks)

7 These interest rates are paid on investments.

Investment	Interest rate (percent per year)
Less than £10 000	0.8
£10 000 to £19 999	1.2
£20 000 or more	1.5

This flow chart can be used to work out the interest, £ I, earned on an investment of £ x.

7 (a) Phil makes an investment of £2000.

How much interest does Phil earn?

2000×0.008

£ .... 16 .... (2 marks)

7 (b) Sam makes an investment of £36 000.

How much interest does Sam earn?

36000×0.012

£ .... 432 .... (2 marks)

7 (c) Megan's investment earns £225 interest.

= Ends in a **5**

How much was her investment?

x × 0.015 = 225

x = 15000

£ .... 15,000 .... (3 marks)

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8 The interest rate for a savings account depends upon the amount invested.
This flow diagram can be used to work out the balance in an account after 12 months.

Start

Input amount
£ A

A < 15 000 ? — Yes

No

A ≥ 30 000 ? — Yes

No

Increase A by 1.5%   Increase A by 1.4%   Increase A by 1.3%

Output amount
with interest added

End
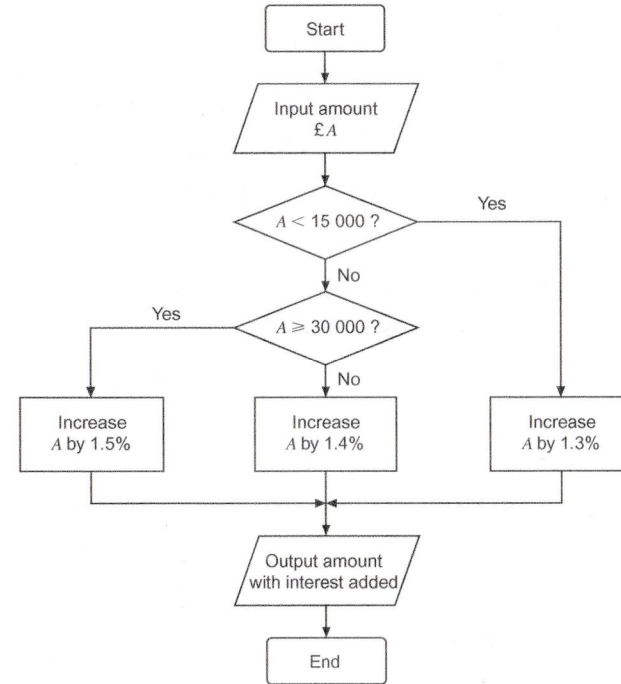
Jill and Karen both invest some money for 12 months.

Jill invests £12 000
Karen invests £4000 more than Jill.

How much **more** money does Karen receive as interest than Jill?

[5 marks]

Jill = £12,000   Karen = £16,000

1.3 × 12000   1.4 × 16,000
15600   22,400

                            22400 - 15600

Answer £   6800

9   Ryan has an income of £52 300 a year.

9 (a)   He does **not** pay tax on the first £9205 of his income.

Work out his taxable income.

52300 - 9205

£   43 095   (1 mark)

9 (b)   He pays the following income tax.

- 20% on the first £32 245 of his taxable income
- 40% on the rest of his taxable income

Work out his income after income tax has been paid.

20% × 32245 = 6449
43095 - 32245 = 10850
40% × 10850 = 4340
6449 + 4340 = 10789 of
                                    tax
52300 - 10789
        = 41511

£   41,511   (5 marks)

*10   Sally has £2000 to invest.

Bank A	Bank B
Leave your money in for 3 years and we guarantee 3.2% per annum compound interest.	2.8% per annum compound interest. Leave your money in for 3 years and we will add a bonus of 1% of your **original** investment.

Which bank will give Sally more interest if she is going to leave her money in for 3 years?
You **must** show your working.

[4 marks]

$$\text{Bank A} \qquad | \qquad \text{Bank B}$$

$2000 \times 1.032^3 \qquad | \qquad 2000 \times 1.028^3$

$\underline{2198.21} \qquad | \qquad 2172.75$

$\qquad\qquad\qquad | \quad + 1\% \text{ of } 2000$

$\qquad\qquad\qquad | \quad + £20$

$\qquad\qquad\qquad | \quad = \underline{2192.75}$

Answer   **Bank A**

11 (a)   The monthly interest rate on a mortgage is 0.4%

Show that this can be expressed as the decimal 0.004

[1 mark]

$$\frac{0.4}{100} = 0.004$$

11 (b)   The monthly payment, P (£), for a mortgage can be calculated using this formula.

$$P = \frac{i \times A}{1 - (1 + i)^{-N}}$$

where i = the monthly interest rate expressed as a decimal
A = the amount borrowed, (£)
N = the number of **monthly** payments

Ian takes out a mortgage for £125 000
The monthly interest rate is 0.4%
He must make monthly payments for 25 **years**.

Work out his monthly payment.
You **must** show your working.

[4 marks]

$$25 \times 12 = 300 \text{ months}$$

$$P = \frac{0.004 \times 125000}{1 - (1 + 0.004)^{-300}}$$

Careful imput into your calculator

£   **716.25**

12   Lisa sees two different accounts advertised at her local building society.

Account 1
Annual gross interest rate 2.75%
Interest calculated and paid monthly

Account 2
AER 2.8%

Lisa wants to open the account with the highest AER(%)

She uses this formula to work out the AER for Account 1

$$AER = \left(\left(1 + \frac{r}{100n} \right)^n - 1 \right) \times 100$$

where $r = 2.75$ and n is the number of times that interest is paid per year.

Which account should Lisa open?
You **must** show your working.

[3 marks]

$n = 12$ as 12 months in the year

$AER \left(\left(1 + \frac{2.75}{100 \times 12} \right)^{12} - 1 \right) \times 100$

$AER = 2.78$

Answer   Account 2

13 (a)   Jared puts £5000 into a savings account.
At the end of each year 3% interest is added to the amount in the savings account.

Jared does not withdraw any money.

Work out the total amount he will have in the account after four years.

5000×1.03^4

Answer £   5627.54   *(3 marks)*

*13 (b)   This formula works out the future value, (F) of an investment.

$$F = P(1 + r)^n$$

P is the amount invested.
r is the annual rate of interest as a decimal.
n is the number of years the money is invested.

Chloe invests £2300 in savings account A.
After **two** years she has £2518 in the account.

Dan invests £2100 in savings account B.
After **three** years he has £2445 in the account.

Which account pays the higher rate of interest?
You **must** show your working.

Ⓒ $2518 = 2300(1+r)^2$
$1.0947826 = (1+r)^2$
$1.04632 = 1+r$
$r = 0.046 = 4.6\%$

Ⓓ $2445 = 2100(1+r)^3$
$1.1642857l = (1+r)^3$
$1.052 = 1+r$
$r = 0.052 = 5.2\%$

Account B

(5 marks)

14 When you buy a house for more than £125 000 you have to pay a tax called stamp duty.

For houses costing up to £925 000, you pay

nothing on the first £125 000 of the property price

2% on the next £125 000 of the property price

5% on any portion of the property price above £250 000

Tom wants to buy a house.
The most Tom can afford to spend on the property, including stamp duty, is £315 500

Work out the highest property price he can afford.
You **must** show your working.

[6 marks]

125000 with no stamp duty

2% of next 125000

2% × 125000 = (2500) SD

Total so far = 252500

Money left = 63000

1.05 × x = 63000

x = 60000 paying

(3000) stamp duty

Answer £ ___310,000___

315,500

− 2500

− 3000

= 310,000