MODEL SOLUTIONS SET

GCSE Mathematics Practice Tests: Set 7

Paper 1H (Non-calculator)

Time: 1 hour 30 minutes

You should have: Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser, calculator. Tracing paper may be used.

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- **Calculators may be used.**
- Diagrams are NOT accurately drawn, unless otherwise indicated.
- You must **show all your working out.**

Information

- The total mark for this paper is 80
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Index Laws

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1. (*a*) Simplify, leaving your answers in index form,

(i) $7^5 \times 7^2 \times 7$

$a^m \times a^n = a^{m+n}$ | $= 7^{5+2+1} = 7^8$

7^8

(ii) $(4^7)^2$

$(a^m)^n = a^{m \times n}$ | $= 4^{7 \times 2} = 4^{14}$

4^{14}

(2)

(*b*) $\frac{5^n \times 5^3}{5^6} = 5^4$

Find the value of n.

Drop Bases | $n + 3 - 6 = 4$

collect | $n - 3 = 4$

(+3) | $n = 7$

$n =$ 7

(2)

(Total for Question 1 is 4 marks)

HCF

2. Find the highest common factor (HCF) of 147, 42 and 252

42 : 1, 2, 3, 6, 7, 14, 21, 42

42 ISN'T A FACTOR OF 147 ... ∴ TRY 21

147 ÷ 21 = 7

252 ÷ 21 = 12

21 | 147 → 7

21 | 252 → 012

21, 42, 63, 84, 105, 126, 147

∴ 21 is a factor of 42, 147 and 252

21

.....

(Total for Question 2 is 2 marks)

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3. The total weight of 3 identical video games is 525 g.
Work out the total weight of 5 of these video games.

Unitary Method

3 games = 525g

(÷3) 1 game = 175g

(×5) 5 games = 875g

3 | 525 → 175g

175 × 5 = 875

875 g

(Total for Question 3 is 2 marks)

Ratio and Proportion

4. The perimeter of a triangle is 90 cm.
The lengths of the sides of the triangle are in the ratios 3 : 5 : 7

Work out the length of the longest side of the triangle.

Sum of parts	3 + 5 + 7 = 15 parts
Total	15 parts = 90 cm
(÷15)	1 part = 6 cm
Longest = 7 parts	7 parts = 42 cm

42 ..... cm

(Total for Question 4 is 3 marks)

Forming and Solving Equations

5

5. There are

x stamps in a small packet
$(x + 3)$ stamps in a medium packet
and $(x + 4)$ stamps in a large packet

The total number of stamps in the three packets is N.

(i) Write down an equation for N in terms of x.
Give your equation in its simplest form.

Total = N | N = small + medium + large
N = x + x+3 + x+4
collect | N = 3x + 7

N = 3x + 7

(2)

There is a total of 61 stamps.

(ii) Work out the number of stamps in the medium packet.

from (a) | N = 3x + 7
61 = 3x + 7
(−7) | 54 = 3x
(÷3) | 18 = x
medium = x + 3 | medium = 18 + 3
= 21

21

(3)

(Total for Question 3 is 5 marks)

Standard Form

6 7.5

3. (a) Write 75 000 in standard form.

7.5×10^4 7.5×10^4

.....

(1)

A computer can carry out a simple calculation in 1 picosecond where

1 picosecond = 10^{-12} seconds.

(b) Write down in standard form the time, in seconds, for this computer to carry out 75 000 simple calculations.

'1 calculation' = 1 picosecond = 10^{-12}

$\times 75000$ ↓

$= 75000$ picoseconds $= 75000 \times 10^{-12}$

$= 7.5 \times 10^4 \times 10^{-12}$

from (a)

$a^m \times a^n = a^{m+n}$

$= 7.5 \times 10^{-8}$

..... seconds

(2)

(Total for Question 3 is 3 marks)

X

4. Sally got 32 out of 80 in a maths test.
She got 38% in an English test.

Converting FDP

Sally wants to know if she got a higher percentage in maths or in English.

Did Sally get a higher percentage in maths or in English? You must show your working.

maths

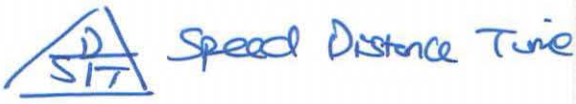
$\frac{32}{80} = \frac{4}{10} = 40\%$

English

38%

$40\% > 38\%$ ∴ Higher in maths

(Total for Question 4 is 2 marks)



8. The length of Emma's journey from her home to her friends house is 72 km.
The journey takes 1 hour 20 minutes.

Work out her average speed in km/h. ← all units in km or h

S = ①
D = 72km
T = 1hour 20 minutes = 1.333 hours = $\frac{4}{3}$ hours

① $S = \frac{D}{T} = \frac{72km}{\frac{4}{3}hours} = \frac{216km}{4hours} = 54km/h$

..... km/h

(Total for Question 8 is 3 marks)

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9. The mean of six numbers is 40
Three of the numbers are 102, 60 and 30
Each of the remaining three numbers is equal to x.

missing mean (Raw Data)

Find the value of x.

Total | $40 \times 6 = 240$

mean = $\frac{\text{Total added}}{\text{Number}}$ | $\therefore \frac{240}{6} = \frac{102+60+30+x+x+x}{6}$

$240 = 102+60+30+x+x+x$

Collect | $240 = 192 + 3x$

(−192) | $48 = 3x$

(÷3) | $16 = x$

$x =$ ..... 16 .....

(Total for Question 9 is 3 marks)

Inverse Proportion

10. y varies inversely as the cube of x.

Given that $y = 24$ when $x = 2$ find the value of x when $y = -3$.

Inverse Proportion

$y = 24, x = 2$

$(\times 8)$

$y \propto \frac{1}{x^3}$

$y = \frac{k}{x^3}$

$24 = \frac{k}{(2)^3}$

$24 = \frac{k}{8}$

$192 = k$

$k = 192$

$y = -3$

$(\times x^3)$

$(\div -3)$

VANS

$y = \frac{192}{x^3}$

$-3 = \frac{192}{x^3}$

$-3x^3 = 192$

$x^3 = -64$

$x = -4$

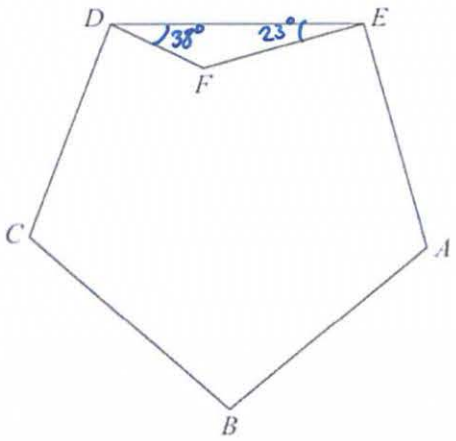
$x =$ ..-4..

(Total for Question 10 is 4 marks)

Angles in Polygons

11

5.



ABCDE is a regular pentagon.

(a) Calculate the size, in degrees, of an interior angle of the pentagon.

Sum of exteriors = 360 | $360° \div 5 = 72°$

Interior + Exterior = 180° | $180° - 72° = 108°$

108 .....°

(2)

The point *F* lies inside the pentagon such that angle *CDF* = 70° and angle *FEA* = 85°

(b) Calculate the size, in degrees, of the **reflex** angle *DFE*.

Each interior = 108° | $108° - 70° = 38° = E\hat{D}F$

$108° - 85° = 23° = D\hat{E}F$

Angle in a triangle = 180° | $180° - 38° - 23° = D\hat{F}E = 119°$

Reflex: Angles around a point = 360° | $360° - 119° = 241°$

241 .....°

(4)

(Total for Question 5 is 6 marks)

Scale Ratios

12.

7. There are 32 students in a class. All the students are either left-handed or right-handed.
The ratio of the number of left-handed students to the number of right-handed students is 1 : 7

(a) Work out the number of right-handed students.

1+7 = 8 parts
32 ÷ 8 = 4
1 : 7
L : R (x4) 4 : 28

28

.....

(2)

Sajid makes a scale model of a bus. He uses a scale of 1 : 32. The length of Sajid's scale model is 45 cm.

Chitra makes a scale model of the same bus. She uses a scale of 1 : 48

(b) Work out the length of Chitra's model bus.

Model : Real
1 : 32
45 : 1440 (x45)

Real size :

45 × 32
90
1350
1440

Chitra's model : (x30)

1 : 48
↓ : 1440 ↑ ÷30
30

0030
48 / 1440

30 cm

(3)

(Total for Question 7 is 5 marks)

Repeated Percentage Change

13.

6. A bank pays compound interest of 1% per annum on its savings accounts.
Evan invests £7500 for 2 years.

Calculate the total interest gained after 2 years.

End of first year: £7500 + 1% = £7575

(1% = £75)

End of 2nd year: £7575 + 1% = £7650.75

(1% = £75.75)

Interest Gain: £7650.75 − £7500

£ 150.75

(Total for Question 6 is 3 marks)

Fibonacci

14. The first three terms of a different Fibonacci sequence are

$$a \quad b \quad a + b$$

(a) Show that the 6th term of this sequence is $3a + 5b$

Term: 1 2 3 4 5 6

a b $a+b$ $a+2b$ $2a+3b$ $3a+5b$

$a+b$ $b+a+b$ $a+b+a+2b$ $a+2b+2a+3b$

(2)

Given that the 3rd term is 7 and the 6th term is 29,

(b) find the value of a and the value of b.

Simultaneous Equations

Term ③ : 7

Term ⑥ : 29

$a+b=7$ ①

$3a+5b=29$ ②

$3a+3b=21$ ③ ⊖

$2b=8$

$b=4$

① × 3 :-

② − ③

(= 2)

In ① :

$a+b=7$

$a+4=7$

$a=3$ (−4)

$a=3, b=4$

(3)

(Total for question 14 is 5 marks)

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15. The probability that Mohammed is late for school tomorrow is 0.05.
The probability that Helen is late for school tomorrow is 0.15.

Probability (Independance)

Sam says that the probability that Mohammed and Helen will both be late for school tomorrow is 0.0075 because $0.05 \times 0.15 = 0.0075$

What assumption has Sam made?

That the two events are ~~mutually exclusive~~ independent

(Total for Question 15 is 1 mark)

Index Laws (Change of Base)

16. Find the value of x when $3^{2x} = \frac{1}{81}$

$81 = 3^4$

$3^{2x} = \frac{1}{3^4}$

$a^{-m} = \frac{1}{a^m}$: Let $x = -1$: $3^{2x} = \frac{1}{3^2}$ ✗

Let $x = -2$: $3^{2x} = \frac{1}{3^4}$ ✓

$x =$ -2

(Total for Question 16 is 2 marks)

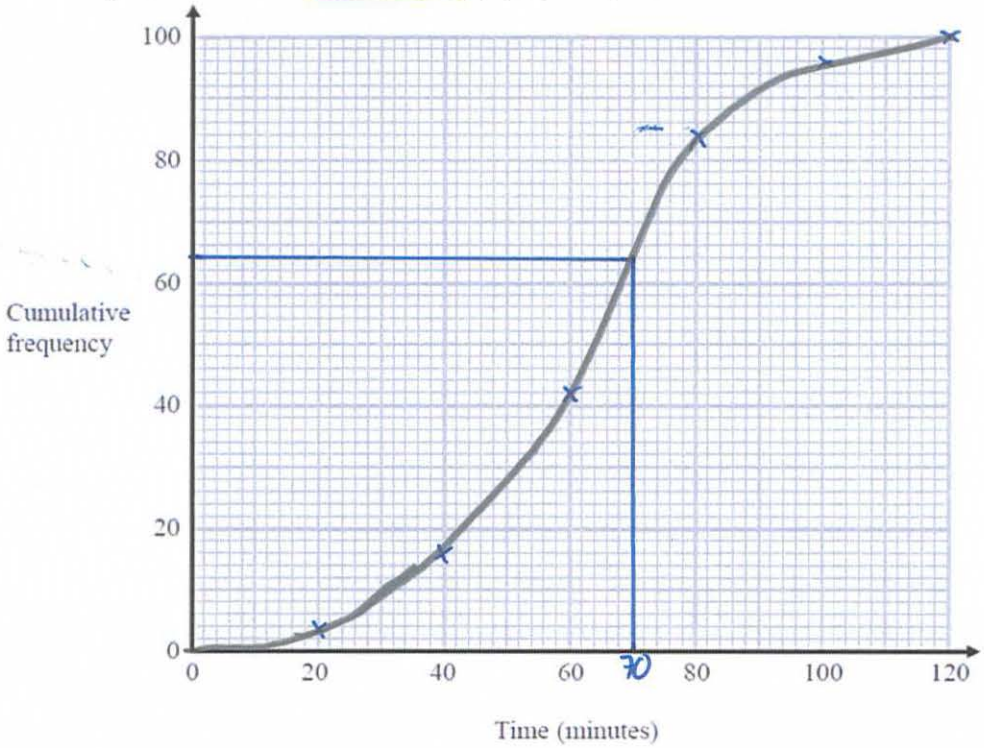
Cumulative Frequency

17. The frequency table gives information about the lengths of time 100 people spent in a coffee shop.

Time (t minutes)	Frequency	C.F
$0 < t \leq 20$	4	4
$20 < t \leq 40$	12	16
$40 < t \leq 60$	26	42
$60 < t \leq 80$	42	84
$80 < t \leq 100$	12	96
$100 < t \leq 120$	4	100

upper bound s

(a) On the grid, draw a cumulative frequency graph for your table.



(2)

(b) Use your graph to find an estimate for the number of these people who spent longer than 70 minutes in the coffee shop.

64 people up until 70 mins

100 people in total

100 − 64 = 36

36

(2)

(Total for Question 7 is 4 marks)

Ratio and Proportion

18.

10. £N is shared between three people in the ratio 2 : 3 : 7
The largest share is £540 more than the smallest share.
Calculate the value of N.

Difference in parts	7 − 2 = 5 parts
Difference in £	= £540
	5 parts = £540
(÷5)	1 part = £108
Total parts	2 + 3 + 7 = 12 parts
Total Amount	12 × £108 = £1296

$$\begin{array}{r} 108 \\ \times\ 12 \\ \hline 216 \\ 1080 \\ \hline 1296 \end{array}$$

$N =$ £1296

(Total for Question 10 is 3 marks)

Simplifying Surds

19.

8. Express $\sqrt{48} + \sqrt{108}$ in the form $k\sqrt{6}$ where k is a surd.

$\sqrt{48} = \sqrt{8}\sqrt{6}$

$\sqrt{108} = \sqrt{18}\sqrt{6}$

$\sqrt{8} = \sqrt{4}\sqrt{2}$, $\sqrt{18} = \sqrt{9}\cdot\sqrt{2}$

$\sqrt{48} + \sqrt{108}$

$= \sqrt{8}\sqrt{6} + \sqrt{18}\sqrt{6}$

$= \sqrt{4}\sqrt{2}\sqrt{6} + \sqrt{9}\sqrt{2}\sqrt{6}$

$= 2\sqrt{2}\sqrt{6} + 3\sqrt{2}\sqrt{6}$

factorise $= \sqrt{6}(2\sqrt{2} + 3\sqrt{2})$

collect $= \sqrt{6}(5\sqrt{2})$

make a surd... $= \sqrt{6}(\sqrt{25}\sqrt{2})$

$= \sqrt{6}\sqrt{50}$

$= \sqrt{50}\sqrt{6}$

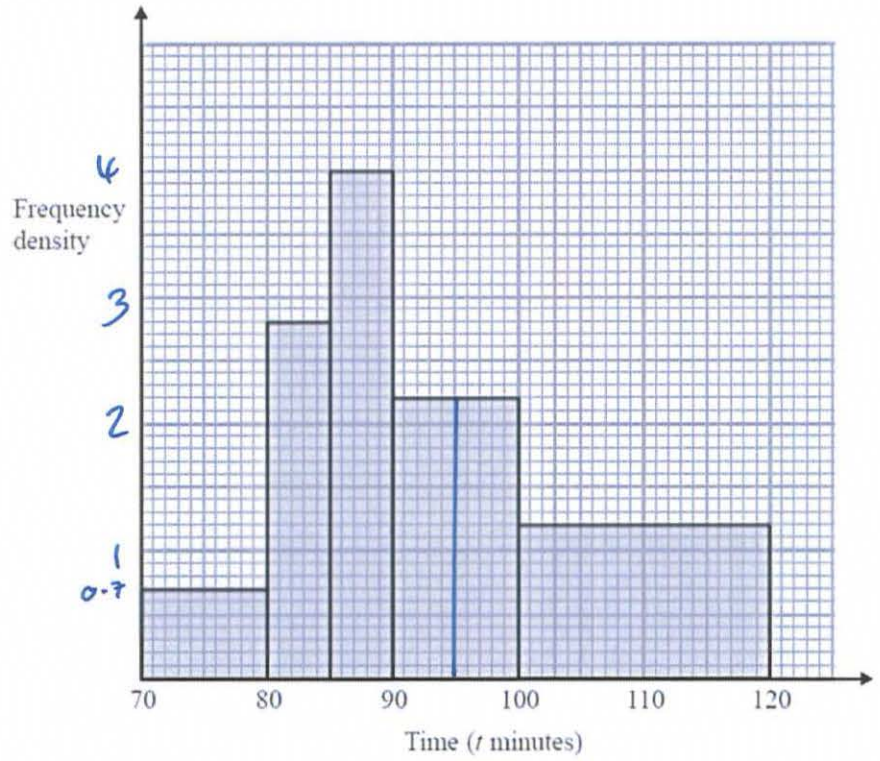
$\sqrt{50}\sqrt{6}$

(Total for Question 8 is 3 marks)

Histograms

20

11. The histogram shows information about the time taken by cyclists to finish a cycle race.



Draw Scale

7 cyclists took 80 minutes or less to finish the race.

(i) Work out an estimate for the number of cyclists who took more than 95 minutes to finish the race.

$\frac{f}{c.w} = f.d$

$\therefore \frac{7}{10} = f.d = 0.7$ ⇒ NOW DRAW SCALE

$x > 95$

$(2.2 \times 5) + (1.2 \times 20)$

$= 11 + 24 = 35$

(ii) Explain why your answer to part (i) is only an estimate.

Because histograms are created from grouped data (intervals).

(Total for Question 11 is 4 marks)

21

9. **C** is the curve with equation $y = x^2 - 4x + 4$

L is the straight line with equation $y = 2x - 4$

L intersects **C** at two points, A and B.

Calculate the exact length of AB.

① $y = x^2 - 4x + 4$

② $y = 2x - 4$

Substitute ② in ①: $2x - 4 = x^2 - 4x + 4$

$(-2x)$ $-4 = x^2 - 6x + 4$

$(+4)$ $0 = x^2 - 6x + 8$

factorise $0 = (x - 4)(x - 2)$

solve $x = 2$ or $x = 4$

In ②: $y = 2x - 4$

If $x = 2$: $y = 2(2) - 4$

$y = 4 - 4$

$y = 0$

$(2, 0)$

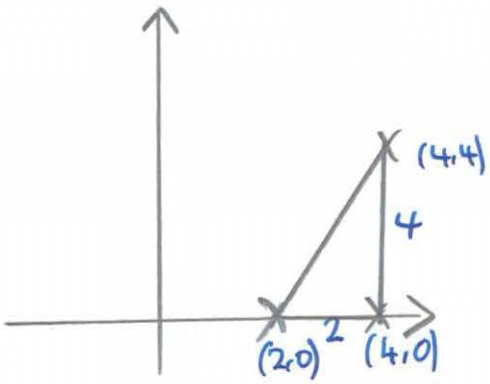
If $x = 4$, $y = 2(4) - 4$

$y = 8 - 4$

$y = 4$

$(4, 4)$

Sketch:



Pythagoras

$a^2 + b^2 = c^2$

$2^2 + 4^2 = c^2$

$4 + 16 = c^2$

$20 = c^2$

$\sqrt{}$ ANS $\sqrt{20} = c$

(Total for Question 9 is 6 marks)

Standard Form

12. $x = a \times 10^n$, where n is an integer and $\sqrt{10} \leq a < 10$.

Find, in standard form, an expression for x^2.
Give your expression as simply as possible.

$x^2 = x \times x$ | $a \times 10^n \times a \times 10^n$

NOT STANDARD FORM → | $= a^2 \times 10^{2n}$

$(\div 10)$ | $= \frac{a^2}{10} \times 10^{2n+1}$

$\frac{a^2}{10} \times 10^{2n+1}$

.....

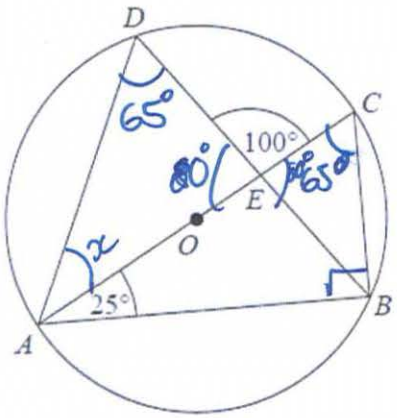
(Total for Question 12 is 3 marks)

TOTAL FOR PAPER IS 40 MARKS

Circle Theorems

23.

10. A, B, C and D are points on the circumference of a circle, centre O.



AC is a diameter of the circle.
AC and BD intersect at E.
Angle $CAB = 25°$
Angle $DEC = 100°$

Work out the size of angle DAC.
You must show all your working.

$A\hat{B}C = 90°$	Angle in a semi-circle $= 90°$
$A\hat{C}D = 180° - 90° - 25°$ $= 65°$	Angles in a triangle $= 180°$
$A\hat{C}B = A\hat{D}C = 65°$	Same segment theorem $\Rightarrow$ angles are equal
Also: $B\hat{E}C = 180° - 100°$ $= 80°$	Angles on a straight line $= 180°$
$A\hat{E}D = 80° = B\hat{E}C$	Vertically opposite angles are equal.
$D\hat{A}C = x° = 180° - 65° - 80°$ $= 35°$	Angles in a triangle $= 180°$

35 °

(Total for question 10 is 4 marks)

TOTAL FOR PAPER IS 40 MARKS