



NEWTON STUDENT SAMPLE PROBLEMS

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PROBLEM 1

Four towns, Alber, Ballin, Coybar, and Dinmar, are to be connected by broadband optical fibre communication cable. Various routes were surveyed to estimate the shortest amounts of cable required between each pair of towns. The results are shown in this table.

town pair	cable length in km
Alber, Ballin	220
Alber, Coybar	250
Alber, Dinmar	210
Ballin, Coybar	190
Ballin, Dinmar	150
Coybar, Dinmar	170

- Find the least amount of cable required to connect just Alber, Ballin, and Coybar.
- If we connect all four towns with the least amount of cable, explain why the links we use between pairs of towns will not form a circuit.
- Find the least amount of cable required to connect all four towns.

PROBLEM 2

- (a) Some hexominoes can be made by joining two straight triominoes together. Draw all of the hexominoes that can be made in this way, showing clearly how the two triominoes are joined.
- (b) Some hexominoes can be made by joining a domino and a 'Z' tetromino together. Draw all of the hexominoes that can be made in this way, showing clearly how the two triominoes are joined.

**PROBLEM 3**

- (a) Write down a rule for multiplying by 31 horizontally.
- (b) Show how it works with the example 31×25468 .
- (c) Show how to check the answer using digit sums.

PROBLEM 4

The vacant squares in this grid are to be filled with digits so that all the numbers read from left to right and top to bottom are 5-digit cubic numbers.

Find *all* possible solutions if the cubic numbers are different. Show clearly why there are no more solutions.

1		2		3
4				

PROBLEM 5

A certain polyhedron has exactly eight faces. Four of the faces are equilateral triangles and the other faces are regular hexagons.

- (a) How many edges does the polyhedron have?
- (b) How many vertices does the polyhedron have?
- (c) Explain why the polyhedron has at least one vertex at which exactly one triangle and two hexagons meet.
- (d) If all vertices are identical, draw a net of the polyhedron and construct the polyhedron out of stiff paper.

PROBLEM 6

The counting numbers are arranged in columns as shown.

column:	1	2	3	4	5	6	7	8	9
row 1	1	2	3	4	5	6	7	8	9
row 2			4	5	6	7	8	9	10
row 3			5	6	7	8	9	10	11
row 4			6	7	8	9	10	11	12
row 5			7	8	9	10	11	12	13

- (a) Complete the next six columns after column 8.
- (b) Find the column in which 50 appears.
- (c) Find the row and column in which 2008 appears.

PROBLEM 7

Fifty-two members of the Highmont Tennis Club bought a ticket each to attend the Australian Open. The ordinary ticket price was \$45 and the concession ticket price was \$36. They spent \$2043 altogether.

- (a) Explain why the number of ordinary tickets and the number of concession tickets is odd.
- (b) Find the number of each type of ticket that was bought.

PROBLEM 8

- (a) Insert one digit somewhere in 347835 to make a number that is divisible by 99. Find all such numbers.
- (b) Insert one digit between 4 and 7 and another digit between 9 and 8 in the number 473598 to make a new number that is divisible by 24. Find all such numbers.