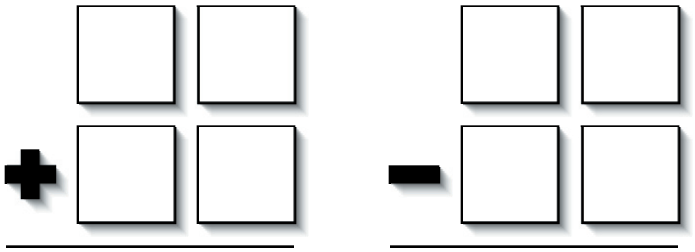
## Part II – For the Teacher

### Curriculum Areas

Problem 1 – Numbers Sense and Numeration
Problem 2 – Geometry and Spatial Sense
Problem 3 – Number Sense and Numeration
Problem 4 – Patterning and Algebra; Measurement
Problem 5 – Patterning and Algebra
Problem 6 – Spatial Sense; Measurement

### Hints and Suggestions

**Problem 1**
Hint 1 – Which digit is most important in determining the greatest (least) sum?
Hint 2 – Think about the hundreds digit first.
Hint 3 – Here is a simpler problem of the same type. Arrange the digits 0, 1, 2, 3 in the given boxes to achieve the greatest possible answer, using each digit once.



*Suggestion:* This activity could be done individually, or in teams. Students could help devise a scoring system.

**Problem 2**
Hint 1 – What symbols appear in all three views?
Hint 2 – What symbols are NOT opposite the open circle?

*Suggestion:* Encourage students to cut out the given net and construct the cube.

**Problem 3**
Hint 1 – If she burns all the candles she makes in b), how many stubs will she have? How many new candles will these stubs make?

*Suggestion:* If students are still stuck; ask a simpler question: If there are 8 stubs, how many new candles can she make? 16 stubs?

**Problem 4**
Hint 1 – How could you use a pattern to solve this problem?

*Suggestion:* If students need more guidance, suggest they make a table showing the number of cubes for each height. Possible materials include cube – a – links, or cm graph paper.

**Problem 5**
Hint 1 – Scale 2 tells you that one Beaver balances two Armadillos.
Hint 2 – How many Armadillos will balance the two Camels on scale 1?

*Suggestion:* Students could experiment with a balance beam, using a 10 gm mass for an Armadillo, a 20 gm mass for a Beaver, and a 25 gm mass for a Camel.

**Problem 6**
Hint 1 – Only one square needs to be cut into pieces.

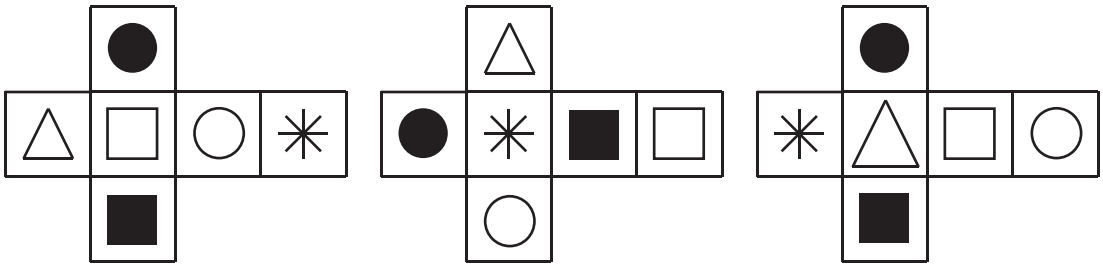
*Suggestion:* Students can cut out the squares; make extra copies of this page so they can experiment.

## Solutions and Notes

**Problem 1**
a) The greatest sum is 1839, from any arrangement of digits with 9 and 8 in the hundreds column, 7 and 6 in the tens column, and 5 and 4 in the units column. The greatest difference is 531, from choosing the greatest possible number in the top row (987), and the least in the bottom row (456).
b) The least sum is 1047, from any arrangement with 4 and 5 in the hundreds column, 6 and 7 in the tens, and 8 and 9 in the units. The least difference is 47, from 745 - 698.

*Extension:* The greatest product is 631 x 542 = 342,002. An interesting question to ask is how you can predict that 631 x 542 is greater than 642 x 531 or 632 x 541. (You want to maximize the number of groups of 600.)

**Problem 2**
Three possible nets for the given cube are:



There are many others.

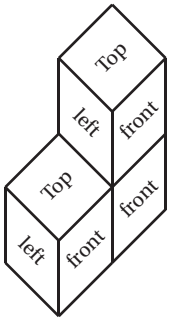
*Extension:* There are 11 possible nets for a cube. Students should construct their cube by cutting out their net and taping it together to prove it is correct.

**Problem 3**
a) Grandma Bev can make 1024/8 = 128 new candles.
b) From the 128 stubs, she can make 128/8 = 16 new candles.
c) From the 16, she makes 2 new candles. Hence the total is 128 + 16 + 2 = 146 candles.

**Problem 4**
1 step requires 1 cube, 2 require 3 cubes, 3 require 6 cubes, 4 require 10, etcetera. At each stage, the number of steps is added to the previous total, so for 99 steps, the number of cubes required is 1 + 2 + 3 + 4 + … + 99.

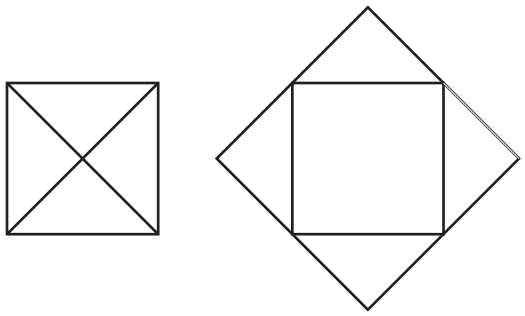
**Note:** Once the pattern is detected, students can use a calculator to find the total. Another possibility is to note that 1 + 99 = 100, 2 + 98 = 100, 3 + 37 = 100, … 49 + 51 =100, giving 49 x 100 plus the 50 in the middle, or 4950 cubes. (This was the solution method used by the ten-year-old Gauss in 1787 for a much more difficult problem.)

*Extension:* For all columns except the last column of cubes (as in the diagram), only one top face, one left face, and all the front and back faces are exposed. On the last column, the 9 faces on the right are also exposed. Thus the total number of exposed faces is 9 tops + 9 left faces + 2 x (1 + 2 + 3 + … + 9) front and back faces + 9 right faces = 117. Hence the amount of paint is 30 x 117 = 3510 ml = 3.51 l.




**Problem 5**
4 Armadillos + 2 Beavers = 4 Camels. Scale 2 tells you that one Beaver balances two Armadillos. Then scale 1 shows that five Armadillos balance two Camels. Finally, scale 3 has ten Armadillos, requiring four Camels.

**Problem 6**
Students may try cutting one square in strips, or smaller squares. The 'easy' solution is to cut one square along both diagonals, forming four right-angle isosceles triangles, and attach one to each of the four sides of the second square.



Some may try to actually find (measure) the length of the side of the side of the larger square; it should be slightly longer than 140 paces.