



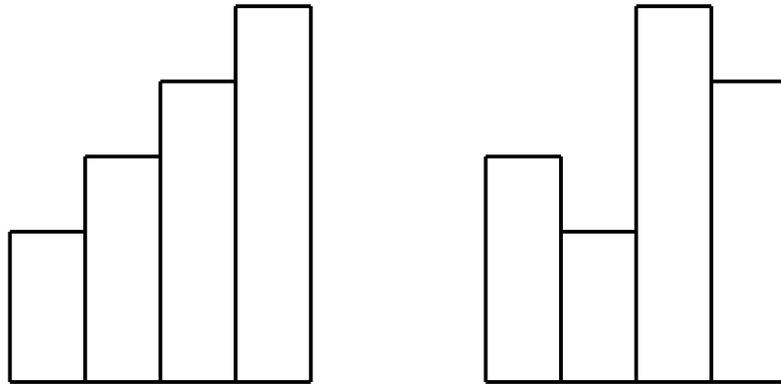
**The University of Melbourne—School of Mathematics and Statistics  
School Mathematics Competition, 2017  
INTERMEDIATE DIVISION**

*These questions are designed to test your ability to analyse a problem and to express yourself clearly and accurately. The following suggestions are made for your guidance:*

- (1) *Considerable weight will be attached by the examiners to the method of presentation of a solution. Candidates should state as clearly as they can the reasoning by which they arrived at their results. In addition, more credit will be given for an elegant than for a clumsy solution.*
- (2) *The **six** questions are not of equal length or difficulty. Generally, the later questions are more difficult than the earlier questions.*
- (3) *It may be necessary to spend considerable time on a problem before any real progress is made.*
- (4) *You may need to do considerable rough work but you should then write out your final solution neatly, stating your arguments carefully.*
- (5) *Credit will be given for partial solutions; however a good answer to one question will normally gain you more credit than sketchy attempts at several questions.*

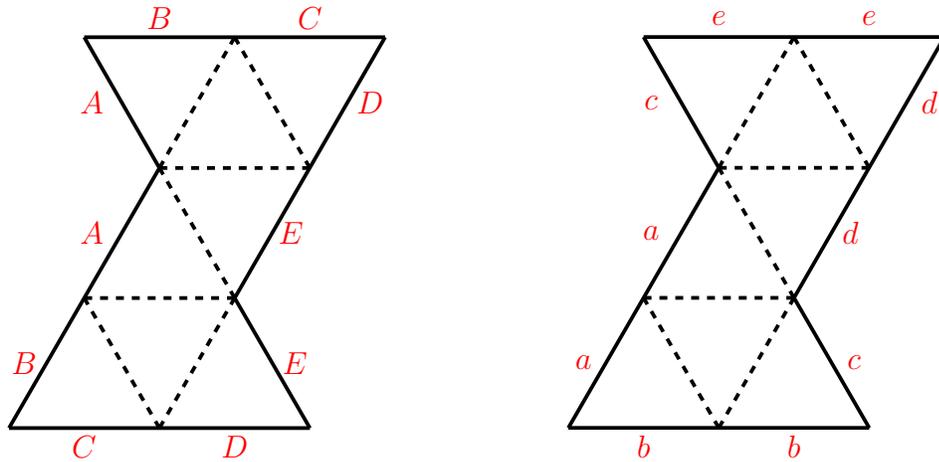
*Textbooks, electronic calculators and computers are **NOT** allowed. Otherwise normal examination conditions apply.*

- (1) A polygon has all interior angles equal to 130 degrees, with the exception of one angle. List all of the possible values of the exceptional angle.
- (2) A train travels at 7 times the speed of a runner. If it takes 8 seconds for the entire train to pass the runner when they are traveling in the same direction, how long will it take for the entire train to pass the runner when they are traveling in opposite directions?
- (3) Consider four rectangles of dimensions  $1\text{cm} \times 2\text{cm}$ ,  $1\text{cm} \times 3\text{cm}$ ,  $1\text{cm} \times 4\text{cm}$  and  $1\text{cm} \times 5\text{cm}$  stacked next to each other along a 4cm horizontal base. Two possible ways to stack them are shown in the diagram. What is the difference between the shortest and longest possible perimeters of such arrangements?



- (4) Each day a boy meets his mother at the train station after school and then she drives him home. She always arrives exactly on time to pick him up. One day he catches an earlier train and arrives at the station one hour earlier. He immediately begins walking home along the same route his mother drives, both traveling at constant speed. Eventually, his mother sees him on her way to the station and drives him the rest of the way home. When they arrive home, the boy notices that they arrived 30 minutes earlier than usual. How much time did the boy spend walking?

- (5) The net below is folded in two different ways to form two solid shapes. The letters in each diagram show which edges must meet, so for example edge  $A$  is glued to edge  $A$ . If the volumes enclosed by each of the two solid shapes are given by  $V$  for the diagram on the left, and  $v$  for the diagram on the right, then calculate  $V/v$ .



- (6) Find all positive integers  $n$  satisfying

$$n = 11111 \times (\text{sum of the digits of } n).$$