2024 Maths Challenge

Middle Primary

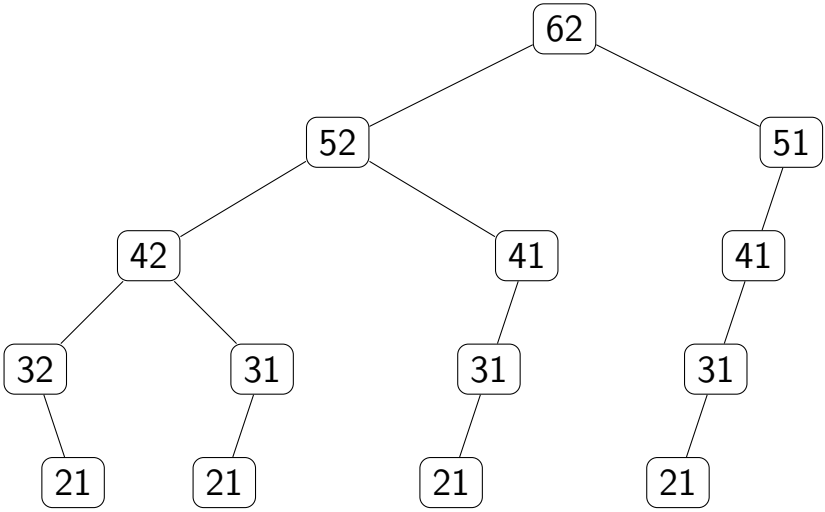
Student Problems

AUSTRALIAN MATHS TRUST

MATHS CHALLENGE

MP3 Drop Bears

Drop bears live in nests in drop bear trees. Each nest has a number. The nest with the largest number is called *home* and its number is used to name the tree. For example, the following diagram shows drop bear tree 62.



The nest numbers are called *addresses* and all have 2 digits. The first digit is always greater than the second digit and no digit is 0. For example,

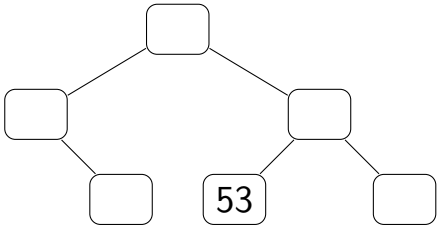
- 53 is an address since 5 is greater than 3
- 35 is not an address since 3 is not greater than 5

- 44 is not an address since the first digit is not greater than the second
- 50 is not an address since no digit can be 0.

Drop bears do a special subtraction to work out the number of their nest. Starting from home, to get the next address below and to the left, they subtract 1 from the first digit. To get the next address below and to the right, they subtract 1 from both digits. Drop bear trees are always drawn until no more nests can be added.

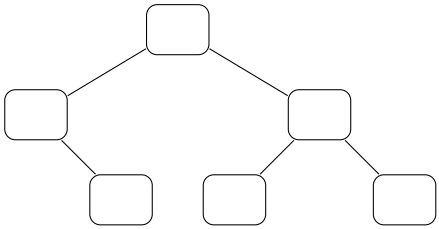
a Draw drop bear tree 53.

b This diagram shows part of a drop bear tree. One of the nests has address 53.



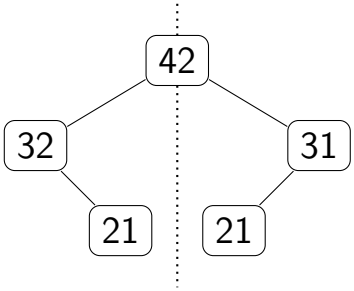
Copy this diagram and fill in the addresses of the five blank nests.

c This diagram shows part of a drop bear tree.



There are two different ways to fill in the addresses of the six blank nests so that at least one nest has address 43. Draw both ways.

d Ignoring the addresses, drop bear tree 42 is symmetrical about the vertical line through home, as shown. Find a symmetrical drop bear tree with more than five nests but fewer than 20 nests.



2025 Maths Challenge

Middle Primary

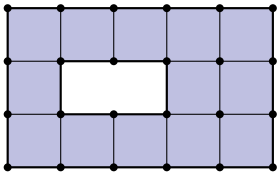
Student Problems

AUSTRALIAN MATHS TRUST

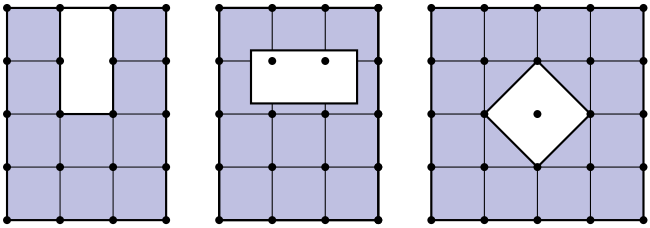
MATHS CHALLENGE

MP4 Holey Rectangles

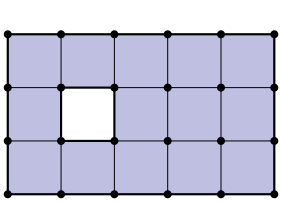
A *holey rectangle* is made by 'removing' a small rectangle from a large rectangle. Each rectangle is drawn on the lines of a square grid. The smaller rectangle is completely inside the larger rectangle, not touching any of its sides. For example, here is a holey rectangle with a 2×1 rectangle completely inside a 5×3 rectangle:

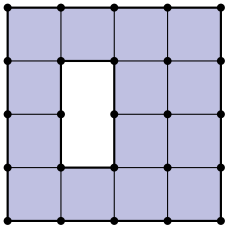


The diagrams below are *not* holey rectangles. In the first example, the inside rectangle is touching a side of the outside rectangle. In the second and third, the inside rectangle has not been drawn on grid lines.

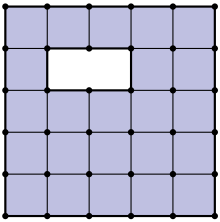


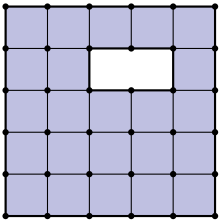
The area of a holey rectangle is the number of *shaded* grid squares. For example, here are two different holey rectangles with area 14:

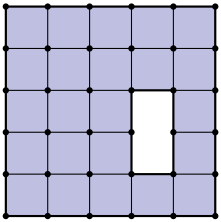




Two holey rectangles are the same if one can be flipped (reflected) or turned (rotated) or both, to make the other. For example, these three holey rectangles are the same:







a Draw three different holey rectangles with area 14 that are different from both of those shown above.

b Draw six different holey rectangles with area 16.

c Draw three holey rectangles that have the same height, one with area 8, one with area 10, and one with area 12.

d Tenzin says he can make a holey rectangle with any *odd* area greater than 9 that anyone specifies. How can he be sure this is possible?