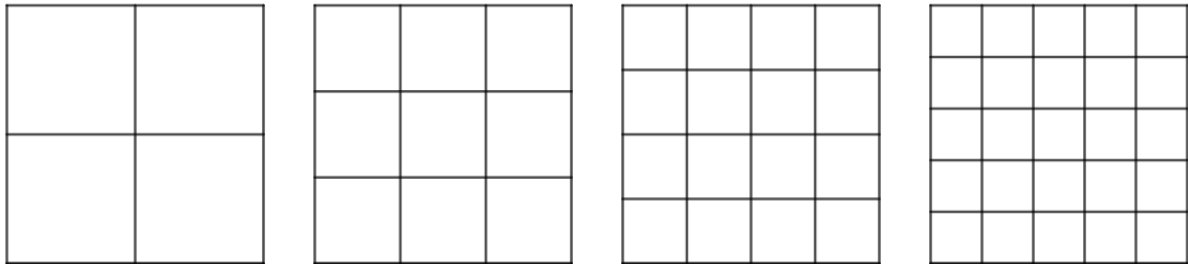


Name: \_\_\_\_\_ School: \_\_\_\_\_



## Izzi Math Challenge 2025 - Grade 7

1. On the square grids below, shade 2 squares in each grid so that the resulting grid has rotational symmetry of order 2. In how many different ways can this be done on an  $n \times n$  square grid? Give your answer as an expression in terms of  $n$ .



2. Draw accurately all possible non-congruent pentagons with the following characteristics:

- A line of symmetry
- A side of 8cm adjacent to sides of 5cm and 6cm
- Exactly two 10cm long diagonals

3. Over the course of three months, the price of a widget increased by 8%, decreased by 12% and increased again by 9%. What is the net relative change in the price of a widget for the period?

4. Given a polygon, we shall call "superexterior" an angle which complements an interior angle of the polygon to  $360^\circ$ , like the marked angles in the diagram. Let  $n$  be the number of sides of a polygon. Write an expression in terms of  $n$  for the sum of the superexterior angles. Give your expression in its simplest form.

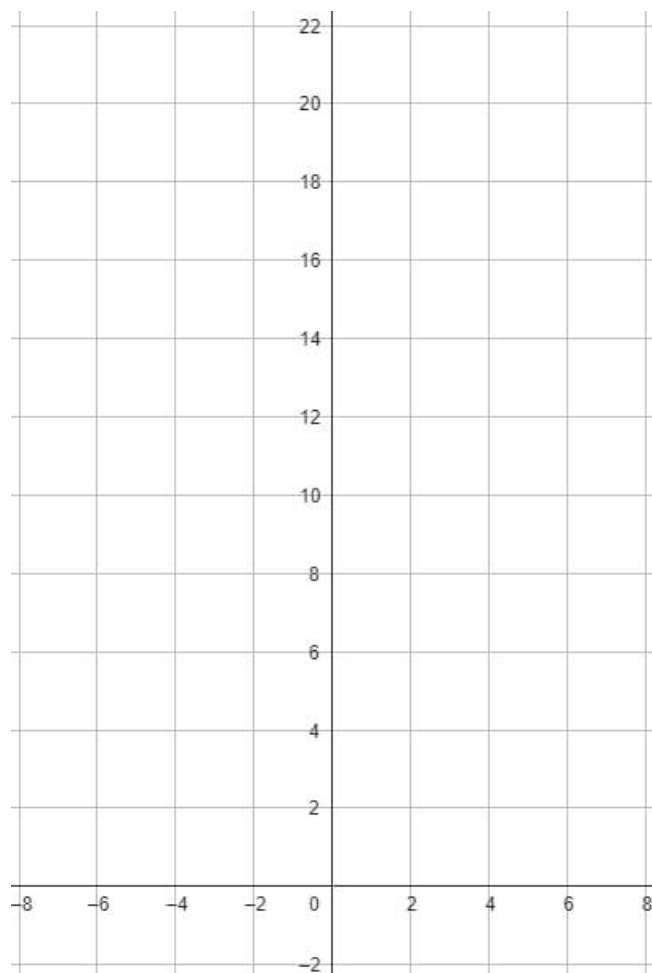
5. When a car moves at a constant speed ( $v$ ) for a while (time  $t$ ), you can express the distance ( $S$ ) it covers by the formula  $S = vt$ . This formula can then be re-written with either  $t$  or  $v$  as the subject, giving  $t = \frac{S}{v}$  and  $v = \frac{S}{t}$  respectively. On the other hand, when a car moving with speed  $v$  starts to steadily increase that speed and does so for a time  $t$ , the distance it covers is expressed by the formula  $S = \frac{at^2}{2} + vt$ , where  $a$  is called the acceleration.

Overall the term  $\frac{at^2}{2}$  corrects for the fact that the speed is increasing. Re-write the last formula with  $t$  as the subject.

6. Calculate

$$[(0.41(6) + 0.58(3))^2 + (0.41(6) - 0.58(3))^2] \div \frac{2}{1 - \frac{2 \times 0.41(6) \times 0.58(3)}{0.41(6)^2 + 0.58(3)^2}}$$

7. The graph of the function  $y = x^2 - 3x + 2$  intersects the x-axis at points A and B and the y-axis at point C. Point D is the image of point C under reflection in the line of symmetry of the graph. Sketch the graph and these points on the grid below and calculate the area of the quadrilateral ABCD.



8. Let  $a$  and  $b$  both be integers. The range of the set  $\{1, 4, 7, a, b\}$  is 7. The mean of the set is the same as its median. Find all possible pairs of values for  $a$  and  $b$ .

9. ABCD is a square. BDEF is a rhombus with A, E and F collinear. Find  $\angle ADE$ .

10. A dice game is played by rolling three regular fair dice. A pair (equal scores on two of the dice) is awarded one point and a three-of-a-kind (equal scores on all three dice) is awarded two points. After the initial roll the player is allowed to set down zero, one or two of their dice and re-roll the remaining one(s) for a second chance to score one or two points.

- a) If a player rolls three different numbers on their first roll, do they improve their chances of rolling a 3-of-a-kind by setting down one of their dice?
- b) If a player rolls three different numbers on the first roll, do they optimize their chances of rolling a pair on the second roll by setting down zero, one, or two dice?