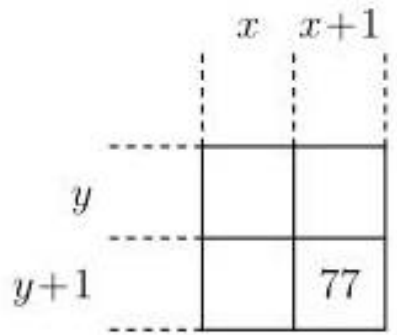
BERKELEY MATH CIRCLE

Math Kangaroo II:
Continued Explorations
in
The Art of Problem Solving

Instructor: Patricio Angulo via Oye Productions

A square of numbers is taken out from a multiplication table. Only one number is visible. The integers x and y are both positive and x is greater than y. What is the value of x?



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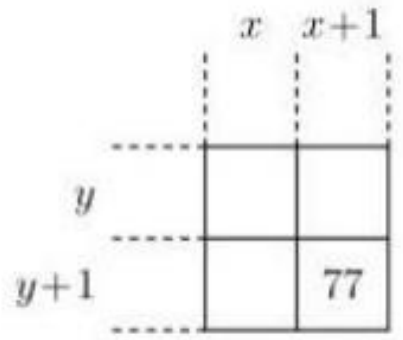

$x+1=7$ $\quad y+1=7$

$y=10$ $\quad y=6$

① $(x+1)(y+1)=77$

7 11

77

77 1

$x+1$

$x=76$

$y+1$

What is the greatest common divisor of $2^{2021} + 2^{2022}$ and $3^{2021} + 3^{2022}$?

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$2^{2021}(1+2)$

$2^{2021}(3)$

$3 \cdot 2^{2021}$

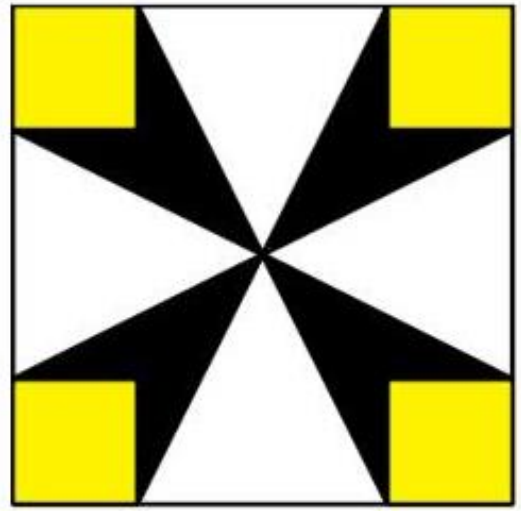
$= 12$

$3^{2021}(1+3)$

$3^{2021}(4)$

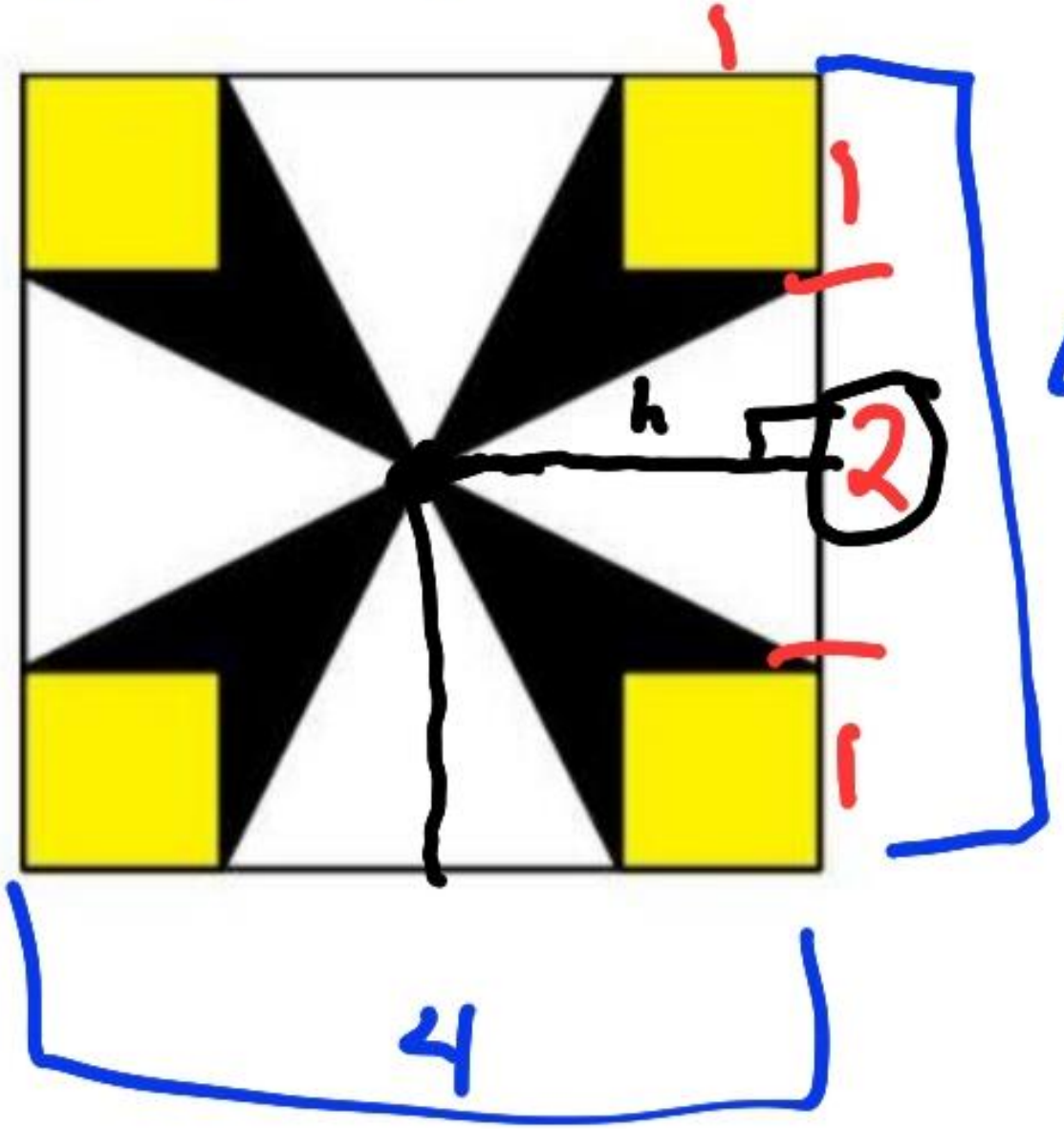
$(3^{2021})(2^2)$

13. The area of the large square is 16 cm^2 and the area of each small square is 1 cm^2. What is the total area of the black flower?



Big Square = 16 → x^2 ⇒ $x = 4$

Small square = $1\,cm^2$ = y^2 ⇓ $y = 1$



$A = \frac{1}{2}bh$

$A = \left(\frac{1}{2}\right)(2)(2)$

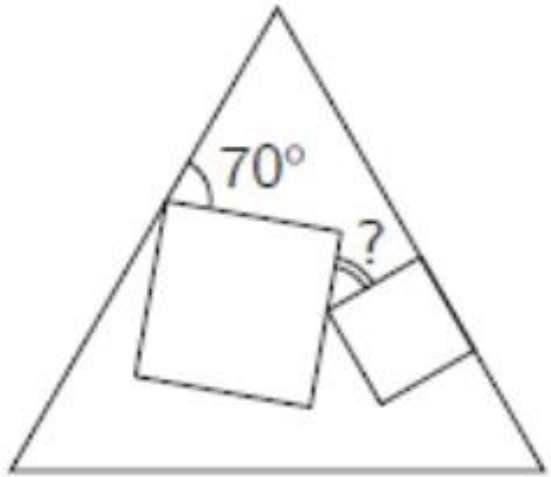
$= 2$

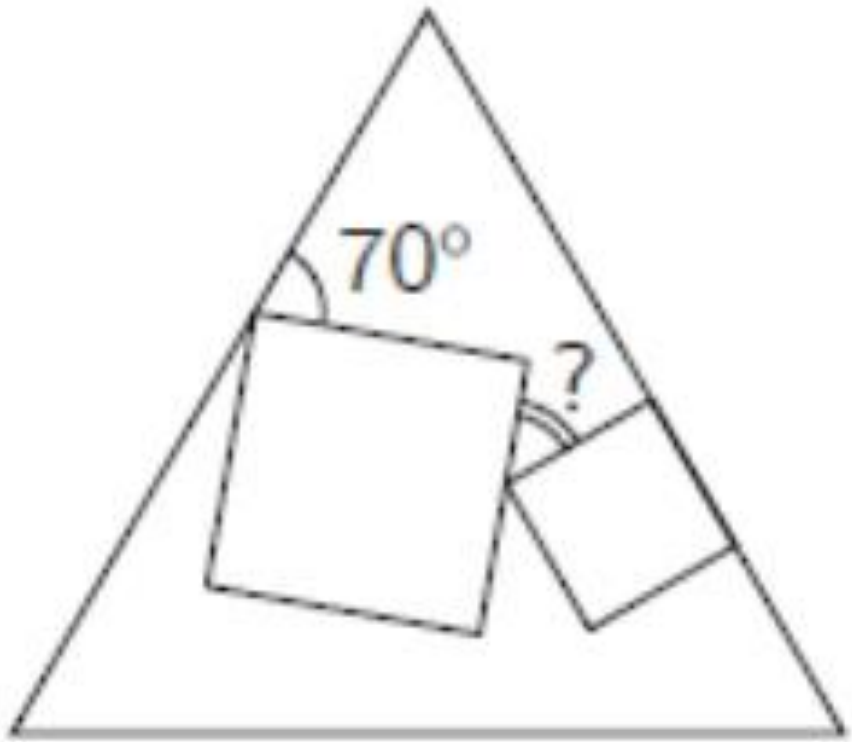
13. The area of the large square is 16 cm^2 and the area of each small square is 1 cm^2. What is the total area of the black flower?

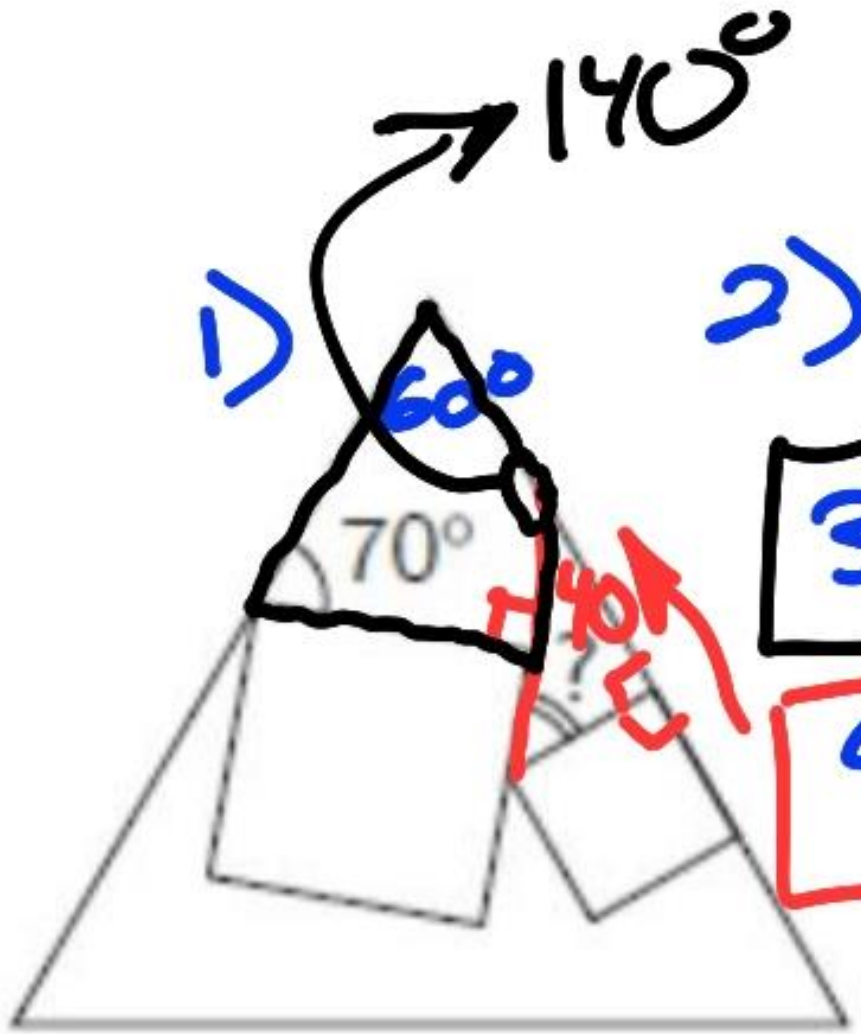
$16 - 4(1) - 4(2)$

$16 - 4 - 8 = 4\ cm^2$

17. Two squares of different size are drawn inside an equilateral triangle. One side of one of these squares lies on one of the sides of the triangle, as shown. What is the size of the angle marked by the question mark?




70°
?



2) Square = 90°

3) Quadrilateral = 360°

4) Line = 180°

$360 = 60 + 70 + 90 + x$

$x = 140$

$180° = 40° + 90° + ?$

$? = 50°$

1. Each year, the third Thursday in March is named Kangaroo Day. The dates of Kangaroo Day for the next few years are shown below, with one error. Which date is wrong?

(A) March 17, 2022
(B) March 16, 2023
(C) March 14, 2024
(D) March 20, 2025
(E) March 19, 2026

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(E) March 19, 2026

1, 8, 15
2, 9, 16
3, 10, 17
4, 11, 18
5, 12, 19
6, 13, 20
7, 14, 21