

1 Squaring Fives

Note 1

Consider these equations:

$$5^2 = 25$$

$$15^2 = 225$$

$$25^2 = 625$$

$$35^2 = 1225$$

$$45^2 = 2025$$

Do you see a pattern? Do you see more patterns? Can you write down a conjecture to describe the patterns you see in natural language? Can you formalize your conjecture and prove it?

2 Perfect Square

Note 1 Let n be a natural number. Prove that if n is odd, then n^2 can be written in the form $8k + 1$ for some integer k .

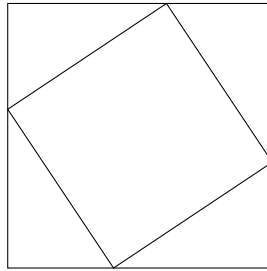
3 Multiplying Division

Note 1 Recall that $a \mid b$ means a divides b . Let $m, n \in \mathbb{Z}$. Prove that if $n \mid m$ and $(n + 1) \mid m$, then

$$n(n + 1) \mid m.$$

4 Pythagorean Theorem

Note 1



Using the above diagram, prove the Pythagorean Theorem: if a and b are the lengths of the legs of a right triangle and c is the length of its hypotenuse, then $a^2 + b^2 = c^2$.

Hint: Look for right triangles in the diagram and label them with a , b , and c .