

Rotten Apples

You need: a computer spreadsheet and square grid paper

ACTIVITY

1. A rotten apple is accidentally packed in the first space in this single-row tray.



Apples that touch rotten apples become rotten themselves after 1 week.

- a. How long will it be before all the apples in the single-row tray become rotten?
- b. A rotten apple is packed in each of the single-row trays shown below. How long will it be before all the apples in each single-row tray become rotten?

Tray A



Tray B



Tray C



Tray D

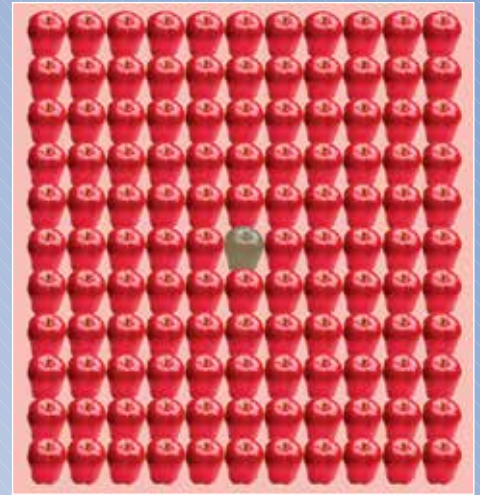


Tray E

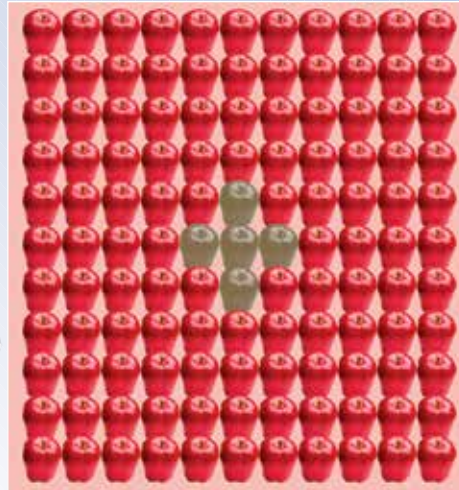


- c. Telea has a rule for working out the *maximum* number of weeks it can take all the apples in a single-row tray to become rotten.
 - i. Explain what you think Telea's rule might be.
 - ii. Telea's friend Kathy says the rule is $n - 1$. Explain Kathy's rule.
- d. Kathy then writes the rule $\frac{n-1}{2}$ for the *minimum* number of weeks it takes an *odd* number of apples in a single-row tray to become rotten. Decide if Kathy's rule is correct and explain your reasoning.
- e. Write an algebraic rule to describe the *minimum* number of weeks it takes an *even* number of apples in a single-row tray to become rotten.
- f. One apple is already rotten when it is packed in a single-row tray. What are the minimum and maximum numbers of apples that can be in that tray if they all become rotten after:
 - i. 21 weeks?
 - ii. 20 weeks?
 - iii. 101 weeks?
 - iv. 100 weeks?

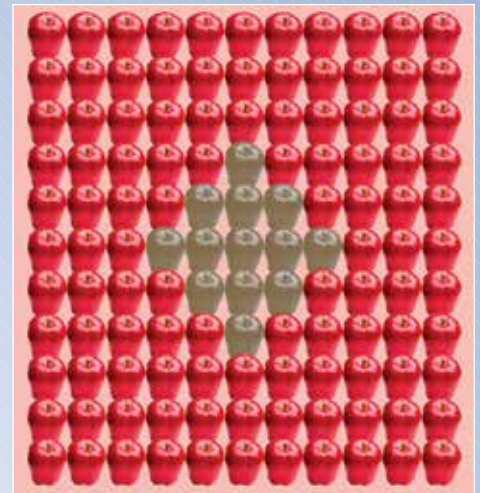
2. A rotten apple is accidentally packed in the middle of a square tray that holds 121 apples.



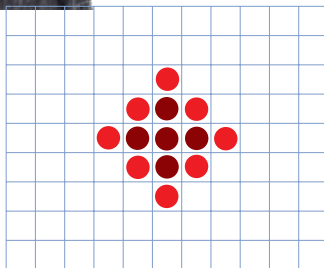
1 rotten apple is packed



4 new rotten apples after 1 week



8 new rotten apples after 2 weeks



- a. i. Complete this diagram to show how many new rotten apples there will be after the third week.
 ii. How many rotten apples will there be altogether after the fourth week?

- b. Kathy works out a rule, $4 \times n$, for calculating the number of new rotten apples after the n th week.
 i. Use Kathy's rule to predict the number of new rotten apples after the seventh week.
 ii. Kathy sets up this spreadsheet to display her findings. Explain what the formula $=C2+B3$ in cell C3 does.
 iii. Make and complete Kathy's spreadsheet up to 12 weeks.

	A	B	C
1	Week	Number of new rotten apples	Total number of rotten apples
2	0	1	1
3	1	4	5
4	2		
5	3		
6	4		
7	5		
8	6		
9	7		

- c. Kathy says that her spreadsheet shows that all the apples in the tray will become rotten after 8 weeks. Telea argues that it will take only 5 weeks.
 i. How does Kathy use her spreadsheet to work out that it will take 8 weeks?
 ii. Explain Telea's reasoning.
 iii. Decide who is correct by working out how long it will take for all the apples in the tray to become rotten.