Chapter 7 Gifted and Enrichment Answers

1. Assume that the bagel is a cylinder with a cylindrical hole in the centre.
$V = \pi(\text{bagel's radius})^2h - \pi(\text{hole's radius})^2h$
$\approx 3.14 \times 5^2 \times 4.5 - 3.14 \times 1.5^2 \times 4.5$
$\approx 353.25 - 31.7925$
≈ 321.5
The volume of the bagel is 321.5 cm^3.

2. 6 m = 600 cm and 4 m = 400 cm
$V(\text{flatbed}) = lwh$
$= 600 \times 400 \times 10$
$= 2\ 400\ 000$
$V(\text{can}) = \pi r^2h$
$\approx 3.14 \times 2.5^2 \times 10$
≈ 196.25
In the 600 cm length, 600 ÷ 5 = 120 cans with 5 cm diameter will fit.
In the 400 cm width, 400 ÷ 5 = 80 cans with 5 cm diameter will fit.
So, 120 × 80, or 9600 cans will fit.
Volume of 9600 cans
= 9600 × 196.25
= 1 884 000
Difference in volume of flatbed and 9600 cans
= 2 400 000 – 1 884 000
= 516 000
The unoccupied space in the flatbed is 516 000 cm^3.

3. $V(\text{jawbreaker}) = \frac{4}{3}\pi r^3$
$\approx \frac{4}{3} \times 3.14 \times 2.5^3$
≈ 65.4

$V(\text{any flavour}) = 65.4 \div 5$
$= 13.08$
$V(\text{orange}) = \frac{4}{3}\pi r^3$
$13.08 \approx \frac{4}{3} \times 3.14 \times r^3$
$13.08 \approx 4.19 \times r^3$
$3.12 \approx r^3$
Use guess and test to find the value of r that when cubed is about 3.12.
I know it is less than 2.5, which is the radius of the entire jawbreaker.
Try 1.5: $1.5^3 = 3.375$, a bit big
Try 1.4: $1.4^3 = 2.744$, a bit small
Try 1.46: $1.46^3 \approx 3.112$, close enough
The diameter of the orange sphere is 2 × 1.46 or 2.92 cm.

4. Use guess and check.
Try $x = 4$
$V = A(\text{base}) \times h$
$= \frac{1}{2} \times 4 \times 8 \times 10$
$= 160$
Increasing base of base by 1 and height of base by 2
$V = A(\text{base}) \times h$
$= \frac{1}{2} \times 5 \times 10 \times 10$
$= 250$
V increase = 250 – 160
= 90
Not enough
Try $x = 6$
$V = A(\text{base}) \times h$
$= \frac{1}{2} \times 6 \times 12 \times 10$
$= 360$
Increasing base of base by 1 and height of base by 2
$V = A(\text{base}) \times h$
$= \frac{1}{2} \times 7 \times 14 \times 10$
$= 490$
V increase = 490 – 360
= 130
Therefore, $x = 6$.

5. Try some numerical examples.
Try side length of 3 cm
$V(\text{prism}) = lwh$
$= 3 \times 3 \times 20$
$= 180$
$V(\text{cylinder}) = A(\text{circle base}) \times h$
$= \pi r^2h$
$\approx 3.14 \times 1.5^2 \times 20$
≈ 141.3
Waste = difference in volume
= 180 – 141.3
= 38.7
38.7 cm^3 as a percent of original prism's volume, 180 cm^3,
$= \frac{38.7}{180} \times 100$
= 21.5%
When tried, other side lengths also give 21.5%. So, the percent of wood wasted turning a square-based prism into a cylinder is 21.5%.