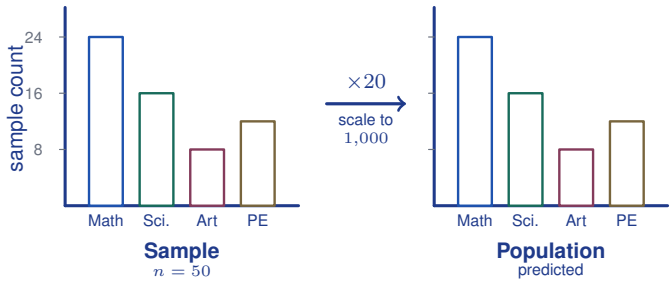
Making Predictions from Samples

Name: _____	Date: _____	Score: _____ / 17

A sample becomes really powerful when you use it to make a **prediction** about the whole population! The idea is simple: if the sample was chosen fairly, the sample proportion can estimate the population proportion. Set up a proportion, solve, and you have a prediction backed by data. This is the exact same reasoning behind opinion polls, product testing, and scientific surveys—and now it is in your toolbox!



Key Concepts & Quick Review

Proportion method: $\dfrac{\text{sample count}}{\text{sample size}} = \dfrac{\text{predicted count}}{\text{population size}}$

Example: 14 out of 50 students prefer pizza. Population $= 800$. Predicted pizza fans: $\dfrac{14}{50} = \dfrac{x}{800} \Rightarrow x = \dfrac{14 \times 800}{50} = 224.$

Examples

① A sample of 40 fish from a lake includes 6 tagged fish. A researcher estimates there are 300 fish in the lake. Predict how many lake fish are tagged.

Think It Through: Set up a proportion by matching sample information to population information: $\frac{6}{40} = \frac{x}{300}$. The left side is the fraction of tagged fish in the sample, so the right side should be the fraction of tagged fish in the whole lake. Cross-multiply to solve: $40x = 6 \times 300$, so $x = 45$. That means the researcher would predict about 45 tagged fish in the lake.

Answer: 45 *tagged fish*

② In a random sample of 60 households, 18 own a dog. The city has $5{,}400$ households. Predict the number of dog-owning households in the city.

Think It Through: Turn the sample into a fraction first: $\frac{18}{60} = \frac{3}{10} = 30\%$. That means about 30% of the households in the sample own a dog. Apply the same proportion to the full city using $\frac{18}{60} = \frac{x}{5400}$, which gives $x = 1620$. So the best prediction is that about $1{,}620$ households in the city own a dog.

Answer: $1{,}620$ *households*

Practice Problems

Use proportional reasoning to make predictions.

1. In a sample, 3 of 25 like jazz. Predict the count in a population of 500. _____
2. In a sample, 8 of 40 chose vanilla. Predict the count in a population of 360. _____
3. In a sample, 12 of 50 are left-handed. Predict the count in a population of 1,000. _____
4. In a sample, 5 of 20 prefer biking. Predict the count in a population of 840. _____
5. In a sample, 9 of 30 read daily. Predict the count in a population of 2,100. _____
6. In a sample, 7 of 35 recycle. Predict the count in a population of 4,200. _____
7. In a sample, 15 of 60 own cats. Predict the count in a city of 3,600. _____
8. In a sample, 6 of 40 fish are tagged. Predict tagged fish out of 250. _____
9. In a sample, 20 of 80 like a new logo. Predict the count out of 5,000. _____
10. In a sample, 4 of 16 prefer dark chocolate. Predict the count out of 400. _____
11. In a sample, 11 of 55 bike to school. Predict the count out of 660. _____
12. In a sample of 100, 38 exercise daily. Predict the count in a population of 8,500. _____
13. In a sample, 2 of 25 items are defective. Predict defects in a batch of 4,000. _____
14. In a sample, 14 of 70 support a new park. Predict supporters out of 21,000. _____
15. In a sample, 3 of 15 prefer e-books. Predict the count out of 3,000. _____

Study Tips

- Set up the proportion with the **same units in matching positions**: sample fraction on the left, population fraction on the right.
- **Predictions are estimates**, not exact counts. Round to the nearest whole number when predicting people or objects.
- Larger samples produce more **reliable** predictions. A sample of 5 might be wildly off; a sample of 500 is much more trustworthy.

Word Problems

16. Biologists use a **capture-recapture** method to estimate wildlife populations. They tag 80 deer and release them. Later, they capture 60 deer and find that 12 are tagged. Use a proportion to estimate the total deer

population. If the actual population is 420, what is the percent error of the estimate? _____

17. A quality inspector checks a random sample of 75 light bulbs from a factory that produces $15{,}000$ bulbs per day. She finds 3 defective bulbs. Predict the number of defective bulbs in the full day's production. The factory's acceptable defect rate is below 1% of daily output. Does today's batch meet this standard based on the sample? _____

Answer Keys

1) 60
2) 72
3) 240
4) 210
5) 630
6) 840
7) 900
8) 37.5
9) 1,250
10) 100
11) 132
12) 3,230
13) 320
14) 4,200
15) 600
16) $N = 400$; percent error about 4.8%
17) 600 defective; 4% defective; does not meet the standard

Step-by-Step Explanations

Strategy: For Surface Area of Pyramids, add the base area to the triangular face areas, using slant height for each triangle. Students should check that slant height, not vertical height, is used for triangular faces.

Practice 1: Find the surface area of the square pyramid. **Answer:** 96
For the first sample, find the base area and add the triangular side faces, using slant height for the triangles.

Practice 15: Use $B = 80$, $P = 36$, and $\ell = 7$ to find the surface area. **Answer:** 206
Late in the set, find the base area and add the triangular side faces, using slant height for the triangles.

Word-problem notes:

16. Answer: $\ell = \sqrt{138^2 + 115^2} = \sqrt{19044 + 13225} = \sqrt{32269} \approx 179.6\,m$; lateral $SA = 2(230)(179.6) \approx 82{,}616\,m^2$; days ≈ 165.
The slant height runs from the midpoint of a base edge to the apex, so use a right triangle with legs $138\,m$ and $230/2 = 115\,m$. That gives $\ell = \sqrt{138^2 + 115^2} \approx 179.6\,m$. Since the question asks for lateral surface area only, do not include the square base. For a square pyramid, lateral area is $2b\ell = 2(230)(179.6) \approx 82{,}616\,m^2$. At $500\,m^2$ per day, divide the total area by 500 to get about 165 days.

17. Answer: $SA = 8^2 + 2(8)(10) = 64 + 160 = 224\,cm^2$; batch: $200 \times 224 = 44{,}800\,cm^2$.
Because the foil covers the whole outside, include both the base and the triangular faces. Use $SA = b^2 + 2b\ell = 8^2 + 2(8)(10) = 224\,cm^2$ for one pyramid. For a batch of 200 pyramids, multiply 224×200 to get $44{,}800\,cm^2$ of foil.

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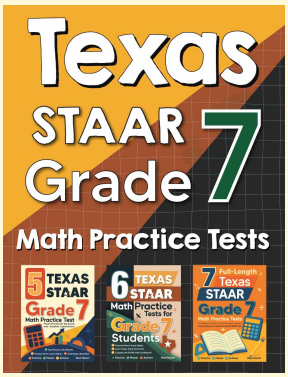

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