

Algebra 2 · Statistical Experiments, Simulation and Decisions · Worksheet Answer Key

Common Core S-IC.A.2, S-IC.B.5, S-IC.B.6, S-MD.B.6, S-MD.B.7 · mathovore.fr

This algebra 2 inference worksheet answer key solves all 25 problems of the statistical experiments, simulation and decisions worksheet step by step.

Every worksheet problem is solved here step by step, with the final answer in bold.

Compare your simulation counts, expected values and probabilities with the key, and note how each conclusion follows from the 5% guideline or from the sign of the expected value.

Algebra 2 Common Core: S-IC.A.2 · S-IC.B.5 · S-IC.B.6 · S-MD.B.6 · S-MD.B.7

Algebra 2 Inference Worksheet Answer Key: problems 1-5

Problem 1: Expected count of fives

(a) Expected fives: $90 \cdot \frac{1}{6} = 15$.

(b) $27 - 15 = 12$ more fives than expected.

(c) $\frac{27}{90} = 0.30$, compared with $\frac{1}{6} \approx 0.167$.

Answers: **(a) 15; (b) 12; (c) 0.30.**

Problem 2: Spinner model

(a) Each section is equally likely, so $P(\text{red}) = \frac{1}{4} = 0.25$.

(b) $50 \cdot 0.25 = 12.5$ reds are expected.

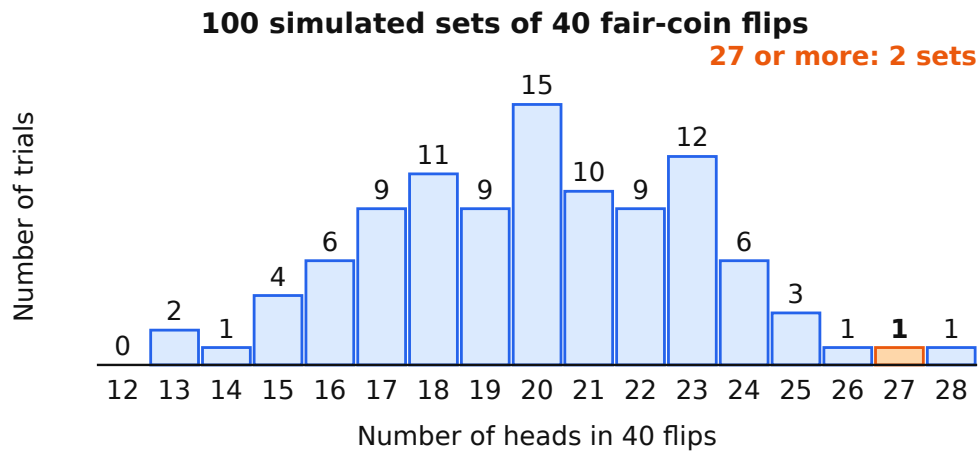
(c) $\frac{22}{50} = 0.44$, much higher than 0.25.

Answers: **(a) 0.25; (b) 12.5; (c) 0.44.**

Problem 3: Read a coin simulation

(a) $40 \cdot \frac{1}{2} = 20$ heads.

(b) Adding the bars at 27 and above gives 2 sets.



Highlighted bars hold the simulated sets with 27 or more heads: 2 of 100.

(c) $\frac{2}{100} = 0.02$, or 2%.

(d) A result this extreme happens in about 2% of fair-coin sets, below 5%. It is not consistent with a fair coin.

Answers: **(a) 20; (b) 2 sets; (c) 0.02; (d) not consistent.**

Problem 4: Free-throw shooter

(a) $20 \cdot 0.8 = 16$ made shots.

(b) Add the first four counts: $0 + 1 + 3 + 4 = 8$ sets.

(c) $\frac{8}{100} = 0.08$, which is above 5%. A game this poor is not unusual for an 80% shooter, so it is consistent with his claim.

Answers: **(a) 16; (b) 8; (c) consistent.**

Problem 5: Design a simulation

(a) Let the digits 0, 1 and 2 mean a prize and 3 to 9 mean no prize. Three of ten digits give $P(\text{prize}) = 0.3$.

(b) One trial is 12 random digits, one per box. Record how many digits are 0, 1 or 2.

(c) Repeat for at least 100 trials and count the trials with 1 prize or fewer. If that count is a small share (under 5%), the 30% claim is doubtful; otherwise Mia's result is consistent with it.

Answer: **digits 0-2 = prize; 12 digits per trial; compare the share of trials with 1 or fewer prizes to 5%.**

Algebra 2 Inference Worksheet Answer Key: problems 6-10

Problem 6: Ten rolls, no six

(a) $P(\text{no six}) = \frac{5}{6}$.

(b) The rolls are independent: $\left(\frac{5}{6}\right)^{10} \approx 0.1615$.

(c) A probability of about 16% is well above 5%, so ten rolls without a six are not unusual. The result is consistent with a fair die.

Answers: **(a) $\frac{5}{6}$; (b) 0.1615; (c) consistent.**

Problem 7: Random assignment methods

Method 1 is random assignment because chance alone decides who gets the new fertilizer, and every group of 5 is equally likely.

Methods 2 and 3 use plant traits, so the groups differ before treatment and a later difference could come from height or sprouting time.

The number of ways to choose 5 of 10 plants is $\frac{10 \cdot 9 \cdot 8 \cdot 7 \cdot 6}{5 \cdot 4 \cdot 3 \cdot 2 \cdot 1} = \frac{30,240}{120} = 252$.

Answer: **Method 1; 252 ways.**

Problem 8: Compare typing methods

(a) Game: $\frac{276}{8} = 34.5$ wpm. Drills: $\frac{248}{8} = 31$ wpm.

(b) $34.5 - 31 = 3.5$ wpm.

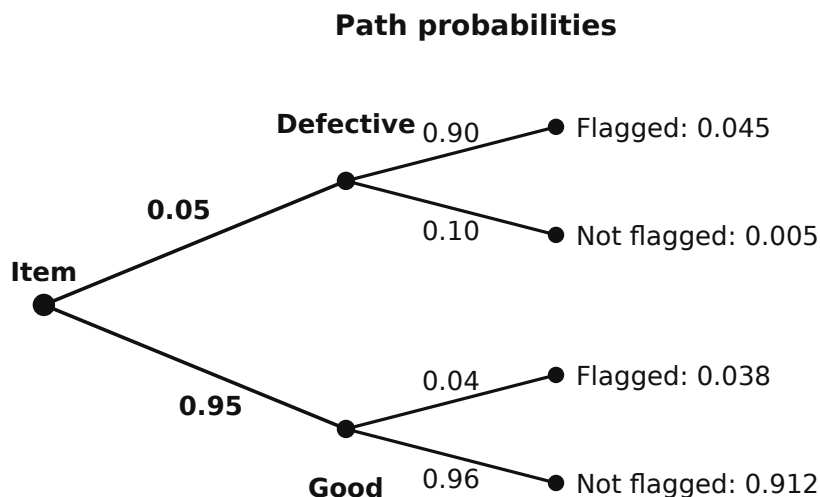
(c) The groups overlap, with both having students from 31 to 34 wpm. Random assignment could produce a gap of 3.5 wpm by luck, so a simulation is needed to judge how often.

Answers: **(a) 34.5 and 31; (b) 3.5 wpm.**

Problem 9: Re-randomize the typing data

(a) The bars labeled 4 and 5 hold differences from 3.5 upward.

(b) Their counts add to 1.



The two flagged paths add to 0.083.

(c) $\frac{1}{500} = 0.002$, below 0.05. The difference is statistically significant: chance alone rarely produces it.

Answers: **(b) 1; (c) 0.002, significant.**

Problem 10: Significant or not

A result is significant when the probability is below 0.05.

Experiment 1: $0.003 < 0.05$, significant. Experiment 2: $0.12 > 0.05$, not significant. Experiment 3: $0.048 < 0.05$, significant. Experiment 4: $0.31 > 0.05$, not significant.

For Experiment 1, chance alone would give a difference this large only 0.3% of the time, about 3 in 1,000, so the treatment is the likely cause.

Answer: **Experiments 1 and 3.**

Algebra 2 Inference Worksheet Answer Key: problems 11-15

Problem 11: Types of studies

(a) Experiment with random assignment. It can support a cause-and-effect conclusion.

(b) Observational study; no treatment is assigned. It shows association only.

(c) Patients chose their own pill, so it is not randomly assigned. It shows association only, since the choosers may differ in other ways.

Answers: **(a) experiment, causal; (b) observational; (c) observational.**

Problem 12: Biased sample report

Problem 1: the sample is not random. Students in the Pizza Friday line chose pizza, so they are more likely to like it.

Problem 2: 18 students is a small sample, so results vary a lot. The report rounds $\frac{15}{18} \approx 0.833$ to 83%.

Improvement: choose a random sample (for example, random student ID numbers) from the whole school and ask more students.

Answer: **biased, small sample; use a larger random sample.**

Problem 13: Cause or association

The survey only observed adults. No one was randomly assigned to drink coffee, so the study shows an association, not cause and effect.

A hidden (confounding) factor could explain it. Adults with more income may afford coffee and healthcare, and they may also live longer.

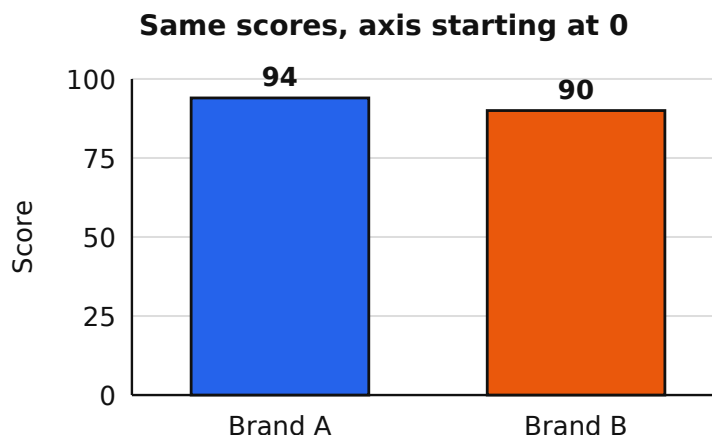
To test the claim, randomly assign volunteers to drink or not drink coffee and compare outcomes.

Answer: **observational data cannot show that coffee causes longer life.**

Problem 14: Misleading graph

(a) With the axis starting at 88, Brand A's bar has height $94 - 88 = 6$ units and Brand B's has $90 - 88 = 2$ units. Brand A looks 3 times as tall.

(b) $\frac{94 - 90}{90} = \frac{4}{90} \approx 0.044$, about 4.4% higher.



With the axis starting at 0, the bars are almost the same height.

(c) Start the vertical axis at 0. The bars then look almost equal, as the scores are.

Answers: **(a) 3 times as tall; (b) about 4.4%.**

Problem 15: Fair choice of one friend

(a) Ava: 1 or 2. Ben: 3 or 4. Carla: 5 or 6.

(b) Each friend has $\frac{2}{6} = \frac{1}{3}$ probability.

(c) Two flips have 4 equally likely outcomes, and 4 cannot be split into three equal groups. One outcome would have to trigger another flip.

Answers: **(a) 1-2, 3-4, 5-6; (b) $\frac{1}{3}$ each.**

Algebra 2 Inference Worksheet Answer Key: problems 16-20

Problem 16: Sum of two dice

Of the 36 equally likely outcomes, a sum of 2 to 6 occurs in $1+2+3+4+5=15$ ways. A sum of 8 to 12 occurs in $5+4+3+2+1=15$ ways. A sum of 7 occurs in 6 ways.

Ignoring the rerolled 7s, 30 outcomes remain. Dana: $\frac{15}{30} = \frac{1}{2}$. Eli: $\frac{15}{30} = \frac{1}{2}$.

The plan is fair.

Answer: **each has probability $\frac{1}{2}$; fair.**

Problem 17: Choose one of five

(a) Roll again after a 6, so the result is among 1 to 5 with equal chance: each cousin has probability $\frac{1}{5}$.

(b) At least three rolls means the first two rolls are both 6: $\frac{1}{6} \cdot \frac{1}{6} = \frac{1}{36}$.

(c) Each roll succeeds with probability $\frac{5}{6}$, so the expected number of rolls is $1 \div \frac{5}{6} = \frac{6}{5} = 1.2$.

Answers: **(a) $\frac{1}{5}$ each; (b) $\frac{1}{36}$; (c) 1.2 rolls.**

Problem 18: Fair prize for a die game

(a) Net +\$3 with probability $\frac{1}{6}$, net -\$1 with probability $\frac{5}{6}$: $\frac{1}{6} \cdot 3 + \frac{5}{6} \cdot (-1) = \frac{3-5}{6} = -\frac{1}{3}$, about -\$0.33.

(b) The expected net is not 0, so the game is not fair; it favors the organizers.

(c) Let the prize be x . The expected net is $\frac{x-1}{6} - \frac{5}{6} = \frac{x-6}{6}$, which is 0 when $x = 6$.

Answers: **(a)** $-\$0.33$; **(b)** not fair; **(c)** $\$6$.

Problem 19: Raffle value

(a) $300 + 2 \cdot 50 = \$400$.

(b) $\frac{400}{500} = \$0.80$ per ticket.

(c) A buyer's expected net is $0.80 - 2.00 = -\$1.20$. The club takes in $500 \cdot 2 = \$1,000$ and pays $\$400$, a profit of $\$600$, which is $500 \cdot 1.20$.

Answers: **(a)** $\$400$; **(b)** $\$0.80$; **(c)** $-\$1.20$ per ticket, $\$600$ profit.

Problem 20: Phone warranty decision

Without the warranty: $0.08 \cdot 300 = \$24$ expected cost.

With the warranty: $\$40$ for certain.

Since $24 < 40$, skipping the warranty is cheaper on average by $\$16$.

A person may still buy it to avoid the risk of a sudden $\$300$ expense they could not afford.

Answer: **skip the warranty (expected $\$24$ versus $\$40$)**.

Algebra 2 Inference Worksheet Answer Key: problems 21-25

Problem 21: Medical test outcomes

(a) With the condition: $10,000 \cdot 0.02 = 200$, so $0.90 \cdot 200 = 180$ test positive and 20 test negative. Without it: 9,800, so $0.05 \cdot 9,800 = 490$ test positive and 9,310 test negative. Positives total $180 + 490 = 670$.

10,000 people tested

	Has condition	No condition	Total
Test positive	180	490	670
Test negative	20	9,310	9,330
Total	200	9,800	10,000

Green: true positives. Pink: false positives. Orange: all positive tests (670).

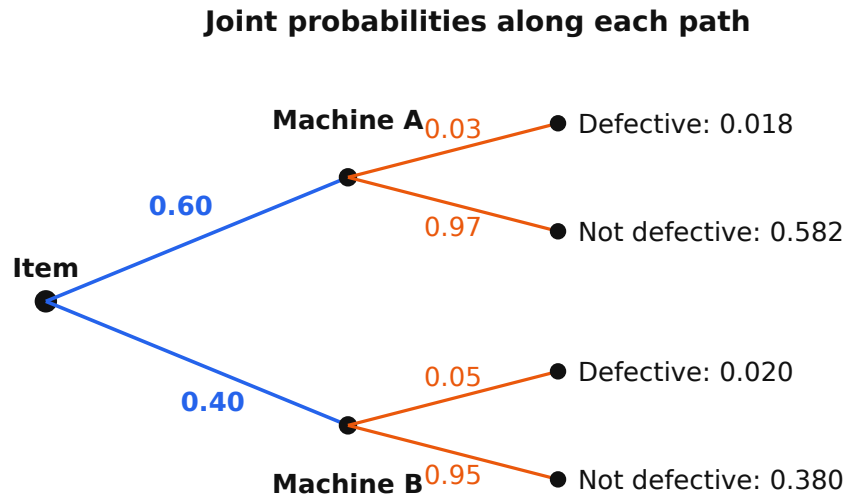
(b) $\frac{180}{670} \approx 0.269$, about 27%.

(c) Most positive tests are false alarms because so few people have the condition.

Answer: **about 27%.**

Problem 22: Which machine made it

(a) A and defective: $0.60 \cdot 0.03 = 0.018$. B and defective: $0.40 \cdot 0.05 = 0.020$. Total $0.018 + 0.020 = 0.038$.



Multiply along a path to get its probability.

(b) $\frac{0.020}{0.038} = \frac{10}{19} \approx 0.526$.

(c) Machine B causes about 52.6% of defects despite making fewer items, so inspect Machine B first.

Answers: **(a) 0.038; (b) about 0.526; (c) Machine B.**

Problem 23: Kick or go for two

(a) Kick: $0.94 \cdot 1 = 0.94$ points. Two-point play: $0.48 \cdot 2 = 0.96$ points.

(b) The two-point play scores 0.02 more points per attempt on average.

(c) Trailing by 2, only a successful two-point play ties the game, while a kick leaves the team behind. The goal then matters more than the average points.

Answers: **(a) 0.94 and 0.96; (b) two-point play.**

Problem 24: Interpret re-randomization

(a) $\frac{8}{500} = 0.016$, or 1.6%.

(b) $0.016 < 0.05$, so the difference is statistically significant.

(c) Because assignment was random, the study app is the likely cause of the higher scores. If 60 of the 500 matched, the estimate would be $\frac{60}{500} = 0.12$, above 0.05. The difference could easily be chance and would not be significant.

Answers: **(a) 0.016; (b) significant; (c) likely caused by the app.**

Problem 25: Headache relief experiment

(a) Pill X: $\frac{21}{30} = 0.70$. Pill Y: $\frac{12}{30} = 0.40$. Difference: 0.30.

(b) $\frac{18}{1000} = 0.018$.

(c) This is below 0.05, so the difference is statistically significant. Since patients were randomly assigned, pill X is the likely cause of the better relief rate, though a 30-patient group is small.

Answers: **(a) 0.70, 0.40, 0.30; (b) 0.018; (c) significant.**

How to use this algebra 2 inference worksheet answer key

Read this algebra 2 inference worksheet answer key after trying each problem yourself, and redo any problem you missed.

