

Chi-Square Tests for Two-Way Tables

Grade 12 – AP Statistics math · Test · Standards: AP Statistics Unit 3 (2026-27)

Name: _____ Date: _____ Class: _____

This 45-minute test has eight AP-style questions worth 20 points. State hypotheses in context, check the expected-count condition, show the statistic, df and p-value, and write each conclusion in context.

Standards: AP Statistics Unit 3 (2026-27) · **Level:** Grade 12 AP Statistics

Time: 45 minutes · 8 questions · Total: 20 points · Calculator: as allowed by your teacher

Question 1 Choosing the Procedure (2 points)

A researcher takes a random sample of 200 students from each of two districts and asks each student how they travel to school (walk, bike, bus or car). The researcher wants to know whether the distribution of travel method is the same in both districts. (a) Name the test. (b) State the hypotheses and give the degrees of freedom.

Question 2 Expected Counts (2 points)

A random sample of 200 people was classified by sex and favorite type of movie.

	Comedy	Drama	Action	Total
Female	44	36	20	100
Male	28	40	32	100
Total	72	76	52	200

Find the expected count for the female and drama cell and for the male and action cell.

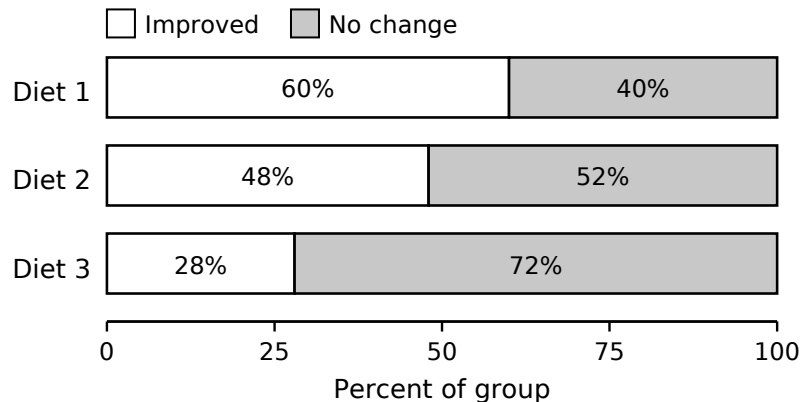
Question 3 Test of Independence (3 points)

Use the movie table above. The sample is random and there are many more than 2,000 people in the population. Test whether sex and favorite type of movie are associated. (a) State the hypotheses and check conditions. (b) Find χ^2 , df and the p-value. (c) State a conclusion at $\alpha = 0.05$.

Question 4 Test of Homogeneity (3 points)

Volunteers were randomly assigned to three diets (50 each) and classified as improved or no change. The counts are shown with a segmented bar graph.

	Improved	No change	Total
Diet 1	30	20	50
Diet 2	24	26	50
Diet 3	14	36	50
Total	68	82	150



Outcome by diet.

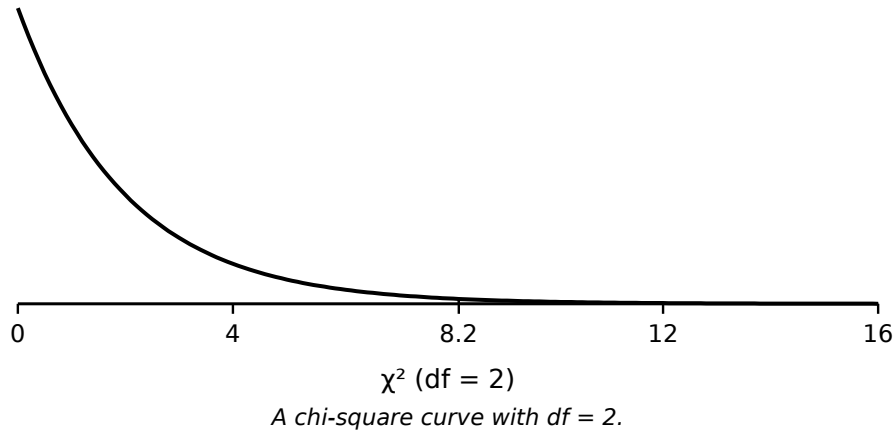
Do the data provide convincing evidence that the distribution of outcomes differs among the three diets? State hypotheses, check conditions, find χ^2 , df and the p-value, and conclude at $\alpha = 0.05$.

Question 5 Checking Conditions (2 points)

A random sample of 60 students was classified by grade level (9, 10, 11) and whether they own a car. The expected counts for the six cells are 12.4, 8.6, 18.0, 9.6, 7.4 and 4.0. A student states that the conditions for a chi-square test are met because the sample is random. Evaluate this statement.

Question 6 Interpreting a p-Value (2 points)

A test of homogeneity gives $\chi^2 = 8.2$ with $df = 2$, as shown.



- Find the p-value. (1 point)
- Interpret it in the context of comparing the distributions of favorite season in two towns. (1 point)

Question 7 Observational or Experimental (3 points)

Study 1: A random sample of 250 adults is classified by whether they use a fitness tracker and whether they meet the weekly activity goal. Study 2: 250 volunteers are randomly assigned to use or not use a fitness tracker for a month, and each is classified as meeting or not meeting the goal. Both studies produce a chi-square p-value of 0.01. (a) State the conclusion the p-value supports in each study. (b) Explain why the conclusions differ.

Question 8 Contributions to Chi-Square (3 points)

A test of independence between age group (under 30, 30 or older) and preferred streaming service (A, B, C) gave a significant result. The table shows each cell's observed count, expected count and contribution to the statistic.

	A	B	C
Under 30: observed / expected	58 / 45.2	31 / 34.2	21 / 30.6
Under 30: contribution	3.62	0.29	3.03
30 or older: observed / expected	32 / 44.8	37 / 33.8	40 / 30.4
30 or older: contribution	3.65	0.29	3.06

- Which two cells contribute most? (b) Describe how those cells differ from independence. (c) Which service shows the least association with age?