

Limits, Probability, and Statistics: math practice, Grade 12 – download the PDF

22 problems graded by difficulty (★ easy, ★★ medium, ★★★ hard). Try first, without looking at the solutions!

1 Reading a limit from a table

★ ★ ★

Let $f(x) = \frac{x^2 - 16}{x - 4}$. Complete the table, then estimate $\lim_{x \rightarrow 4} f(x)$.

x	3.9	3.99	4.01	4.1
$f(x)$	?	?	?	?

2 One-sided limits of a piecewise function

★ ★ ★

Let $h(x) = \begin{cases} x + 2 & x < 1 \\ 6 - x & x \geq 1 \end{cases}$. Find $\lim_{x \rightarrow 1^-} h(x)$, $\lim_{x \rightarrow 1^+} h(x)$, and decide whether $\lim_{x \rightarrow 1} h(x)$ exists.

3 Two limits at infinity

★ ★ ★

Find (a) $\lim_{x \rightarrow \infty} \frac{5x - 2}{x + 7}$ and (b) $\lim_{x \rightarrow \infty} \frac{3}{x^2 + 1}$.

4 Podium or committee?



From 6 students, (a) how many ways can a president and a vice president be chosen? (b) how many ways can a 2-person team be chosen?

5 Marbles without replacement



A bag holds 5 red and 3 blue marbles. Two marbles are drawn one after the other without replacement. Find the probability that both are red.

6 Coin flips



A fair coin is flipped 4 times. What is the probability of exactly 3 heads?

7 Computing z-scores



Test scores have mean 70 and standard deviation 10. (a) Find the z-score of a score of 85. (b) Which score has $z = -2$?

8 Limit by factoring



Find $\lim_{x \rightarrow 3} \frac{x^2 + x - 12}{x - 3}$.

9 Three limits at infinity



Find each limit as $x \rightarrow \infty$, or say that it grows without bound: (a) $\frac{4x^3 - x}{2x^3 + 9}$; (b) $\frac{x^2 + 1}{3x^3 - 2}$; (c) $\frac{x^3}{x^2 + 4}$.

10 Arrangements of BANANA



How many different 6-letter arrangements can be made with all the letters of the word BANANA?

11 Choosing a committee



A school club has 6 girls and 5 boys. A committee of 3 girls and 2 boys is chosen. How many committees are possible?

12 Laptops and tablets



In a survey, 60% of students own a laptop and 45% own both a laptop and a tablet. A student who owns a laptop is chosen. What is the probability that this student also owns a tablet?

13 Free throws, exactly four



A basketball player makes 70% of her free throws. She shoots 5 times, independently. Find the probability of making exactly 4.

14 Reading scores



A reading test is approximately normal with mean 100 and standard deviation 15. Use the empirical rule to find the percent of scores (a) between 85 and 115, (b) above 130.

15 Standard deviation of a short list



Data: 12, 15, 15, 18, 20 (minutes spent on a bike ride). Find the mean, the population standard deviation, and the sample standard deviation to two decimal places.

16 Limit with a conjugate

★★★

Find $\lim_{x \rightarrow 0} \frac{\sqrt{x+9} - 3}{x}$.

17 Asymptotes of a rational function

★★★

Find all horizontal and vertical asymptotes of $f(x) = \frac{3x+6}{x^2-x-2}$.

18 PIN codes

★★★

A 4-digit PIN uses digits 0 to 9 with no digit repeated and cannot start with 0. How many PINs are possible?

19 A medical screening test

★★★

A condition affects 2% of a population. A test is positive for 95% of people who have it and, wrongly, for 4% of people who do not. A person tests positive. What is the probability that the person actually has the condition?

20 Guessing on a quiz

★★★

A quiz has 10 questions with 4 choices each, and a student guesses every answer. Let X be the number correct. Find (a) the mean, (b) the standard deviation, (c) $P(X \geq 1)$.

21 Bolts and tolerances

★★★

Bolt lengths are approximately normal with mean 50 mm (about 1.97 in) and standard deviation 0.4 mm. (a) What percent of bolts are between 49.2 mm and 50.8 mm? (b) Find the z-score of a 50.5 mm bolt. (c) A bolt measures 49.4 mm. Is it unusual? Explain.

22

Price and sales

A shop recorded the price x (in dollars) and the daily sales y (in units):

$(2, 90), (3, 75), (4, 70), (5, 55), (6, 40)$. (a) Find the least-squares line. (b) Find r and interpret it. (c) Interpret the slope and predict sales at a price of 3.50 dollars.

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