Math for AI & Cybersecurity

Ages 16-17 | Future Pros

Explore the math behind data models and a simple historical cipher.

How to use this guide

Read each section, complete its four lab steps, then answer the questions in the online course. The online progress bar advances only after four correct answers.

Section 1: Vectors

LEARNING GOAL: Vectors. Your finished work should demonstrate: A labeled feature plot with a careful comparison.

EXPLAIN THE CONCEPT: A vector is an ordered list of numbers. A simple model may describe an item with features such as two measured values. Keep units and feature order consistent when comparing vectors. Think about where you might use this skill in a real or imaginary project. Describe the problem it helps you solve and how you would recognize a successful result.

ORIGINAL PROJECT LAB: 1. Represent three fictional game characters with speed and strength pairs. 2. Write each pair as a two-number vector. 3. Plot the points on a coordinate plane. 4. Choose two close points and explain the similarity and its limit. Finished result: A labeled feature plot with a careful comparison.

Understand with an example

The idea. A vector represents an ordered set of components with defined meaning. Addition combines corresponding components; a dot product multiplies corresponding components and adds the products. Interpret units and scale before comparing vectors.

Get ready. Let a=(2,1) and b=(3,4) in a fictional two-feature example.

Worked example 1

Follow the reasoning. a+b=(5,5). The dot product is 2 x 3+1 x 4=10. These are different operations with different output types: one produces a vector and the other a scalar.

Worked example 2: change one thing

Compare the result. Scale a by 2 to get (4,2). Its dot product with b is 4 x 3+2 x

4=20. The doubled result reflects the changed scale, not necessarily increased similarity.

Try one action at a time

1. Label component meaning.
2. Compute componentwise addition.
3. Compute paired products and their sum.
4. Scale one input and compare.

A mistake to notice

Pause and check. A larger raw dot product is not automatically evidence of a more similar direction when magnitudes differ.

Your own small challenge

Predict before trying. For c=(1,2), what is a dot c?

Check your thinking

2 x 1+1 x 2=4. Keep component order consistent.

Show what you know. Point, draw, demonstrate, type, speak or use your usual communication tool. A trusted adult can help without choosing your answer.

GO DEEPER: Identify an assumption, test a safe alternative, and explain the trade-off. Keep a short before-and-after record that someone else could follow.

SAFETY CHECK: Apply identity security, social-engineering defense, secure coding, cloud controls, incident handling, data protection, and professional ethics. Use pretend data, never real passwords or private information. Stop and ask a trusted adult if anything seems unsafe.

REVIEW QUESTIONS: What is the main idea? Why does the first step matter? How would you detect a mistake? What evidence proves the result? What would you improve? Answer in your own words before taking the quiz.

PORTFOLIO REFLECTION: Save a drawing, sanitized screenshot, or short note describing the goal, your approach, your evidence, and one lesson learned. Expected result: A labeled feature plot with a careful comparison.

Investigate with pictures and choices

Add vectors (1, 2) and (3, 1).

What is the sum?

1. (4, 3)
2. (3, 2)
3. (4, 2)

Worked reasoning

Answer: (4, 3). Add corresponding components: 1 + 3 and 2 + 1.

Try a changed example

Draw both moves head-to-tail on a grid.

Picture and meaning matches

Vector: Represents ordered components

Probability: Quantifies a defined event

Remainder: Supports modular arithmetic

Ways to respond

Choose, point, draw, demonstrate, type, speak or use your usual communication tool.

A helper can operate the controls while you choose.

Counting support if useful

Use zero to ten counters or dots. Touch each once. The last count names the quantity. Rearrange the same set and check whether anything was added or removed.

Choose this foundation practice only when it fits the learner goal.

My notes: _____

Hands-on lab

1. Represent three fictional game characters with speed and strength pairs.
2. Write each pair as a two-number vector.
3. Plot the points on a coordinate plane.
4. Choose two close points and explain the similarity and its limit.

Finished result: A labeled feature plot with a careful comparison.

Check your understanding

1. Which idea best describes Vectors?

A. It has no purpose in this project.

B. A model can estimate uncertainty, but a probability is not a promise.

C. A vector is an ordered list of numbers.

D. Clock arithmetic wraps around after a fixed number.

2. What is the first step in this lab?

A. Choose two close points and explain the similarity and its limit.

B. Write each pair as a two-number vector.

C. Plot the points on a coordinate plane.

D. Represent three fictional game characters with speed and strength pairs.

3. What should you do after step two?

A. Plot the points on a coordinate plane.

B. Write each pair as a two-number vector.

C. Choose two close points and explain the similarity and its limit.

D. Represent three fictional game characters with speed and strength pairs.

4. Which result shows that your lab is finished?

A. A blank page with no work

B. A labeled feature plot with a careful comparison.

C. A copied answer without checking it

D. A skipped lab

Answer review

1. C. A vector is an ordered list of numbers.

2. D. Start with: Represent three fictional game characters with speed and strength pairs.

3. A. Step three is: Plot the points on a coordinate plane.

4. B. The goal is: A labeled feature plot with a careful comparison.

Section 2: Probability & models

LEARNING GOAL: Probability & models. Your finished work should demonstrate: A small prediction table with accuracy and an error note.

EXPLAIN THE CONCEPT: A model can estimate uncertainty, but a probability is not a promise. Accuracy should be checked with examples, and errors may affect different people in different ways. Think about where you might use this skill in a real or imaginary project. Describe the problem it helps you solve and how you would recognize a successful result.

ORIGINAL PROJECT LAB: 1. Create ten fictional messages, five marked safe and five suspicious. 2. Pretend a classifier labels each message. 3. Count correct and incorrect predictions. 4. Calculate accuracy and describe one error that accuracy alone hides. Finished result: A small prediction table with accuracy and an error note.

Understand with an example

The idea. Conditional probability depends on the group being conditioned on. Distinguish the rate of alerts among actual events from the rate of actual events among alerts. Base rates influence how many alerts are false.
Get ready. A fictional detector checks 100 cases: 10 actual incidents and 90 non-incidents. It alerts on 8 incidents and 9 non-incidents.

Worked example 1

Follow the reasoning. There are 17 alerts, of which 8 are actual incidents. Precision is 8/17, about 47.1%. Recall is 8/10=80%. The denominators answer different questions.

Worked example 2: change one thing

Compare the result. Keep 8 detected incidents but increase false alerts to 18. Precision becomes 8/26, about 30.8%, while recall remains 80%. More false alerts do not change how many actual incidents were detected.

Try one action at a time

1. Write the four outcome counts.
2. Count all alerts.
3. Calculate precision and recall separately.
4. Change false alerts and compare.

A mistake to notice

Pause and check. Do not interpret 80% recall as an 80% chance that any particular alert is a real incident.

Your own small challenge

Predict before trying. How many incidents were missed in the original fixture?

Check your thinking

Two: 10 actual incidents minus 8 detected. There are also 81 true negatives, so all four counts total 100.
Show what you know. Point, draw, demonstrate, type, speak or use your usual communication tool. A trusted adult can help without choosing your answer.
GO DEEPER: Identify an assumption, test a safe alternative, and explain the trade-off. Keep a short before-and-after record that someone else could follow.
SAFETY CHECK: Apply identity security, social-engineering defense, secure coding,

cloud controls, incident handling, data protection, and professional ethics. Use pretend data, never real passwords or private information. Stop and ask a trusted adult if anything seems unsafe.

REVIEW QUESTIONS: What is the main idea? Why does the first step matter? How would you detect a mistake? What evidence proves the result? What would you improve? Answer in your own words before taking the quiz.

PORTFOLIO REFLECTION: Save a drawing, sanitized screenshot, or short note describing the goal, your approach, your evidence, and one lesson learned. Expected result: A small prediction table with accuracy and an error note.

Investigate with pictures and choices

A fair coin is tossed twice.

What is the chance of two heads?

1. 1/2
2. 1
3. 1/4

Worked reasoning

Answer: 1/4. The equally likely pairs are HH, HT, TH and TT. One of four is HH.

Try a changed example

List the outcomes for exactly one head.

Picture and meaning matches

Vector: Represents ordered components

Probability: Quantifies a defined event

Remainder: Supports modular arithmetic

Ways to respond

Choose, point, draw, demonstrate, type, speak or use your usual communication tool. A helper can operate the controls while you choose.

Counting support if useful

Use zero to ten counters or dots. Touch each once. The last count names the quantity. Rearrange the same set and check whether anything was added or removed. Choose this foundation practice only when it fits the learner goal.

My notes: _____

Hands-on lab

1. Create ten fictional messages, five marked safe and five suspicious.
2. Pretend a classifier labels each message.
3. Count correct and incorrect predictions.
4. Calculate accuracy and describe one error that accuracy alone hides.

Finished result: A small prediction table with accuracy and an error note.

Check your understanding

1. Which idea best describes Probability & models?

A. A vector is an ordered list of numbers.

B. A model can estimate uncertainty, but a probability is not a promise.

C. Clock arithmetic wraps around after a fixed number.

D. It has no purpose in this project.

2. What is the first step in this lab?

A. Pretend a classifier labels each message.

B. Count correct and incorrect predictions.

C. Create ten fictional messages, five marked safe and five suspicious.

D. Calculate accuracy and describe one error that accuracy alone hides.

3. What should you do after step two?

A. Pretend a classifier labels each message.

B. Calculate accuracy and describe one error that accuracy alone hides.

C. Create ten fictional messages, five marked safe and five suspicious.

D. Count correct and incorrect predictions.

4. Which result shows that your lab is finished?

A. A small prediction table with accuracy and an error note.

B. A copied answer without checking it

C. A skipped lab

D. A blank page with no work

Answer review

1. B. A model can estimate uncertainty, but a probability is not a promise.
2. C. Start with: Create ten fictional messages, five marked safe and five suspicious.
3. D. Step three is: Count correct and incorrect predictions.
4. A. The goal is: A small prediction table with accuracy and an error note.

Section 3: Modular arithmetic

LEARNING GOAL: Modular arithmetic. Your finished work should demonstrate: An encoded

and decoded sample with a security warning.

EXPLAIN THE CONCEPT: Clock arithmetic wraps around after a fixed number. A Caesar shift uses mod 26 to move letters through the alphabet. It is useful for learning the idea of a cipher but is not secure for real messages. Think about where you might use this skill in a real or imaginary project. Describe the problem it helps you solve and how you would recognize a successful result.

ORIGINAL PROJECT LAB: 1. Number letters A=0 through Z=25. 2. Choose a three-letter fictional word and shift each letter by 3 mod 26. 3. Wrap any value at 26 back to the beginning. 4. Reverse the shift to check your result and explain why the cipher is weak. Finished result: An encoded and decoded sample with a security warning.

Understand with an example

The idea. Modular arithmetic tracks remainders after division by a positive modulus. It models wrap-around positions but is not by itself secure encryption. State the modulus and how negative moves are represented.

Get ready. Use a clock-like ring numbered 0 through 6, with modulus 7.

Worked example 1

Follow the reasoning. Starting at 5 and moving forward 4 gives 9, whose remainder modulo 7 is 2. The ring ending is 2 because passing 6 wraps to 0.

Worked example 2: change one thing

Compare the result. Move backward 3 from 1. The ring ending is 5 because 13=2 and 2 is congruent to 5 modulo 7. Specify the nonnegative ring representative.

Try one action at a time

1. State modulus and positions.
2. Compute the ordinary total.
3. Find its remainder representative.
4. Check the move on a ring.

A mistake to notice

Pause and check. A toy wrap-around transformation is not evidence of cryptographic security.

Your own small challenge

Predict before trying. What is the ending from 6 after moving forward 8 on the same

ring?

Check your thinking

6+8=14, which is 0 modulo 7.

Show what you know. Point, draw, demonstrate, type, speak or use your usual communication tool. A trusted adult can help without choosing your answer.

GO DEEPER: Identify an assumption, test a safe alternative, and explain the trade-off. Keep a short before-and-after record that someone else could follow.

SAFETY CHECK: Apply identity security, social-engineering defense, secure coding, cloud controls, incident handling, data protection, and professional ethics. Use pretend data, never real passwords or private information. Stop and ask a trusted adult if anything seems unsafe.

REVIEW QUESTIONS: What is the main idea? Why does the first step matter? How would you detect a mistake? What evidence proves the result? What would you improve? Answer in your own words before taking the quiz.

PORTFOLIO REFLECTION: Save a drawing, sanitized screenshot, or short note describing the goal, your approach, your evidence, and one lesson learned. Expected result: An encoded and decoded sample with a security warning.

Investigate with pictures and choices

Find 17 modulo 5.

What is the remainder?

1. 5
2. 2
3. 3

Worked reasoning

Answer: 2. Seventeen equals three groups of five plus two.

Try a changed example

Use counters to group another number by five.

Picture and meaning matches

Vector: Represents ordered components

Probability: Quantifies a defined event

Remainder: Supports modular arithmetic

Ways to respond

Choose, point, draw, demonstrate, type, speak or use your usual communication tool.

A helper can operate the controls while you choose.

Counting support if useful

Use zero to ten counters or dots. Touch each once. The last count names the quantity. Rearrange the same set and check whether anything was added or removed.

Choose this foundation practice only when it fits the learner goal.

My notes: _____

Hands-on lab

1. Number letters A=0 through Z=25.
2. Choose a three-letter fictional word and shift each letter by 3 mod 26.
3. Wrap any value at 26 back to the beginning.
4. Reverse the shift to check your result and explain why the cipher is weak.

Finished result: An encoded and decoded sample with a security warning.

Check your understanding

1. Which idea best describes Modular arithmetic?

A. A model can estimate uncertainty, but a probability is not a promise.

B. It has no purpose in this project.

C. A vector is an ordered list of numbers.

D. Clock arithmetic wraps around after a fixed number.

2. What is the first step in this lab?

A. Number letters A=0 through Z=25.

B. Reverse the shift to check your result and explain why the cipher is weak.

C. Choose a three-letter fictional word and shift each letter by 3 mod 26.

D. Wrap any value at 26 back to the beginning.

3. What should you do after step two?

A. Number letters A=0 through Z=25.

B. Wrap any value at 26 back to the beginning.

C. Choose a three-letter fictional word and shift each letter by 3 mod 26.

D. Reverse the shift to check your result and explain why the cipher is weak.

4. Which result shows that your lab is finished?

A. A skipped lab

B. A blank page with no work

C. An encoded and decoded sample with a security warning.

D. A copied answer without checking it

Answer review

1. D. Clock arithmetic wraps around after a fixed number.
2. A. Start with: Number letters A=0 through Z=25.
3. B. Step three is: Wrap any value at 26 back to the beginning.
4. C. The goal is: An encoded and decoded sample with a security warning.

Section 4: Guided Project & Worked Examples

COURSE INVESTIGATION: Base rates change alert interpretation

YOUR PRACTICE INPUT: A toy system reviews 1,000 events: 10 are truly malicious. It finds 8 of those and flags 20 harmless events.

WHY IT WORKS: There are 28 positive alerts, so precision is 8/28 28.6%, while recall is 8/10 = 80%. A high recall does not mean every alert is probably malicious.

PLAN BEFORE YOU ACT: Draw or write the starting state, the question you need to answer, and the evidence you expect to see. A paper trace is acceptable; label it as a prediction unless you actually run a test.

WORK THE CASE: Make both confusion matrices, count investigation workload, and explain the tradeoff using the given toy events.

COMPARE WITH THE EXPECTED RESULT: The conclusion includes the missed events and false-alarm workload and does not extrapolate to real production performance.

EXPLAIN YOUR REASONING: Show the connection between the supplied input, each decision, and your result. If a number, label, or observation differs, return to the first differing step rather than changing several things together.

KEEP YOUR EVIDENCE: Save the initial plan, a drawing or sanitized output, and one explanation of what the result does and does not prove. Use pointing, speech, drawing, typing, or your usual communication method.

LEARNING GOAL: Guided Project & Worked Examples. Your finished work should demonstrate: A completed guided project with documented evidence: Worked notebook, Confusion matrix analysis, Toy modular-arithmetic exercise, Tradeoff explanation.

EXPLAIN THE CONCEPT: Review the course concepts through two applied examples. Use a small probability table to reason about false positives and base rates in alerts.

Work a toy modular-arithmetic example to understand why wraparound operations appear in cryptography without implementing real attacks. Guided project: Create a technical notebook/worksheet connecting vectors or features, probability, rates, and

modular arithmetic to safe AI/security examples. Work with synthetic or fictional information and ask an adult for help when appropriate. Think about where you might use this skill in a real or imaginary project. Describe the problem it helps you solve and how you would recognize a successful result.
ORIGINAL PROJECT LAB: 1. Read both worked examples and explain the reasoning. 2. Create a technical notebook/worksheet connecting vectors or features, probability, rates, and modular arithmetic to safe AI/security examples. 3. Record the steps you completed and the result you observed. 4. Compare your result to the goal and correct one issue. Finished result: A completed guided project with documented evidence: Worked notebook, Confusion matrix analysis, Toy modular-arithmetic exercise, Tradeoff explanation.

Understand with an example

The idea. A technical math notebook should preserve input definitions, calculation steps and interpretation limits. Vector scores, detection metrics and modular positions describe separate objects.
Get ready. Use a=(2,1), b=(3,4); the 100-case detector fixture; and ring start 5 with forward 4 modulo 7.

Worked example 1

Follow the reasoning. The dot product is 10; precision is 8/17 and recall 8/10; ring ending is 2. Label each result so a scalar score is not mistaken for a probability.

Worked example 2: change one thing

Compare the result. Change only the ring move from 4 to 5. Ending becomes 3, while vector and detector outputs stay fixed. This isolates one input rather than altering the whole notebook.

Try one action at a time

1. Record each independent input set.
2. Show calculations with labels.
3. Explain the meaning and limitation.
4. Change one input and trace effects.

A mistake to notice

Pause and check. Do not give a probability interpretation to an uncalibrated numeric

score.

Your own small challenge

Predict before trying. Change a to (1,1) while keeping the other original inputs fixed. What changes?

Check your thinking

The dot product with b becomes 7. The detector metrics remain 8/17 and 8/10, and the original ring ending remains 2.

Show what you know. Point, draw, demonstrate, type, speak or use your usual communication tool. A trusted adult can help without choosing your answer.

GO DEEPER: Identify an assumption, test a safe alternative, and explain the trade-off. Keep a short before-and-after record that someone else could follow.

SAFETY CHECK: Apply identity security, social-engineering defense, secure coding, cloud controls, incident handling, data protection, and professional ethics. Use pretend data, never real passwords or private information. Stop and ask a trusted adult if anything seems unsafe.

REVIEW QUESTIONS: What is the main idea? Why does the first step matter? How would you detect a mistake? What evidence proves the result? What would you improve? Answer in your own words before taking the quiz.

PORTFOLIO REFLECTION: Save a drawing, sanitized screenshot, or short note describing the goal, your approach, your evidence, and one lesson learned. Expected result: A completed guided project with documented evidence: Worked notebook, Confusion matrix analysis, Toy modular-arithmetic exercise, Tradeoff explanation.

Investigate with pictures and choices

A toy shift uses letters numbered 0 to 25 and adds 3 modulo 26.

What follows index 24?

1. Index 1
2. Index 27 without wrapping
3. Index 24 unchanged

Worked reasoning

Answer: Index 1. 24 + 3 = 27, and 27 modulo 26 is one. This is a toy learning cipher, not secure encryption.

Try a changed example

Explain why a small predictable shift does not protect real secrets.

Picture and meaning matches

Vector: Represents ordered components

Probability: Quantifies a defined event

Remainder: Supports modular arithmetic

Ways to respond

Choose, point, draw, demonstrate, type, speak or use your usual communication tool.

A helper can operate the controls while you choose.

Counting support if useful

Use zero to ten counters or dots. Touch each once. The last count names the quantity. Rearrange the same set and check whether anything was added or removed.

Choose this foundation practice only when it fits the learner goal.

My notes: _____

Hands-on lab

1. Read both worked examples and explain the reasoning.
2. Create a technical notebook/worksheet connecting vectors or features, probability, rates, and modular arithmetic to safe AI/security examples.
3. Record the steps you completed and the result you observed.
4. Compare your result to the goal and correct one issue.

Finished result: A completed guided project with documented evidence: Worked notebook, Confusion matrix analysis, Toy modular-arithmetic exercise, Tradeoff explanation.

Check your understanding

1. Which idea best describes Guided Project & Worked Examples?

A. A vector is an ordered list of numbers.

B. Review the course concepts through two applied examples.

C. A model can estimate uncertainty, but a probability is not a promise.

D. It has no purpose in this project.

2. What is the first step in this lab?

A. Create a technical notebook/worksheet connecting vectors or features, probability, rates, and modular arithmetic to safe AI/security examples.

B. Record the steps you completed and the result you observed.

C. Read both worked examples and explain the reasoning.

D. Compare your result to the goal and correct one issue.

3. What should you do after step two?

A. Create a technical notebook/worksheet connecting vectors or features, probability, rates, and modular arithmetic to safe AI/security examples.

B. Compare your result to the goal and correct one issue.

C. Read both worked examples and explain the reasoning.

D. Record the steps you completed and the result you observed.

4. Which result shows that your lab is finished?

A. A completed guided project with documented evidence: Worked notebook, Confusion matrix analysis, Toy modular-arithmetic exercise, Tradeoff explanation.

B. A copied answer without checking it

C. A skipped lab

D. A blank page with no work

Answer review

1. B. Review the course concepts through two applied examples.

2. C. Start with: Read both worked examples and explain the reasoning.

3. D. Step three is: Record the steps you completed and the result you observed.

4. A. The goal is: A completed guided project with documented evidence: Worked notebook, Confusion matrix analysis, Toy modular-arithmetic exercise, Tradeoff explanation.

Section 5: Independent Challenge & Mastery

INDEPENDENT TRANSFER CASE: Base rates change alert interpretation

KEEP THE ORIGINAL BASELINE: A toy system reviews 1,000 events: 10 are truly malicious. It finds 8 of those and flags 20 harmless events.

CHANGE ONE CONDITION: A new threshold finds 6 malicious events and flags 6 harmless events. Precision becomes 50%, while recall falls to 60%.

YOUR TASK: Make both confusion matrices, count investigation workload, and explain the tradeoff using the given toy events.

PREDICT, THEN CHECK: State which part of your original reasoning should remain true and which part must be recalculated or retested. Keep the original and changed results side by side.

REVIEW CRITERIA: The conclusion includes the missed events and false-alarm workload and does not extrapolate to real production performance.

MENTOR DISCUSSION: Explain why the changed condition matters. Identify a tempting

wrong conclusion, show the observation that would challenge it, and choose one next test. A statement of uncertainty is better than inventing a result.
PORTFOLIO NOTE: Keep your baseline, changed input, prediction, observed or paper-traced result, explanation, and one improvement. These practice prompts do not replace the course's existing quiz or final assessment.
LEARNING GOAL: Independent Challenge & Mastery. Your finished work should demonstrate: An independent demonstration with evidence: Worked notebook, Confusion matrix analysis, Toy modular-arithmetic exercise, Tradeoff explanation.
EXPLAIN THE CONCEPT: Apply what you learned without copying the guided solution. Independent challenge: Compare two detection thresholds using a confusion matrix and explain the operational tradeoff. Safety and responsibility: Use toy/synthetic examples; math is for understanding defenses and models, not bypassing real cryptographic or security controls. Reflect on your work: What did you build or discover? What did you test or change after feedback? What safe or responsible choice did you make? Think about where you might use this skill in a real or imaginary project. Describe the problem it helps you solve and how you would recognize a successful result.
ORIGINAL PROJECT LAB: 1. Explain the challenge and make a short plan. 2. Compare two detection thresholds using a confusion matrix and explain the operational tradeoff. 3. Test the result and record evidence of your work. 4. Review the safety scenario and describe one improvement. Finished result: An independent demonstration with evidence: Worked notebook, Confusion matrix analysis, Toy modular-arithmetic exercise, Tradeoff explanation.

Understand with an example

The idea. An independent technical example should be reproducible and internally consistent. Include totals and boundary assumptions so another learner can find a mismatch rather than simply trust the final answer.
Get ready. Create your own two-component vectors, a small detection-count table and a modulus ring move.

Worked example 1

Follow the reasoning. One case uses vectors (1,3) and (2,2), giving dot product 8. A detector has 3 true positives, 1 false positive and 2 false negatives, giving precision 3/4 and recall 3/5. Start 4 plus 3 modulo 5 ends at 2.

Worked example 2: change one thing

Compare the result. Change only false positives from 1 to 3. Precision becomes 3/6=1/2 while recall stays 3/5. The vector product and ring ending remain unchanged.

Try one action at a time

1. Define inputs and allowed interpretations.
2. Compute each output explicitly.
3. Check counts and denominators.
4. Explain one changed-input comparison.

A mistake to notice

Pause and check. Do not invent missing counts merely to produce a complete-looking metric table.

Your own small challenge

Predict before trying. Can you give overall detector accuracy from this example as written?

Check your thinking

No. The true-negative count is not supplied, so the total population and overall accuracy cannot be calculated. Precision and recall use the provided counts.
Show what you know. Point, draw, demonstrate, type, speak or use your usual communication tool. A trusted adult can help without choosing your answer.
GO DEEPER: Identify an assumption, test a safe alternative, and explain the trade-off. Keep a short before-and-after record that someone else could follow.
SAFETY CHECK: Apply identity security, social-engineering defense, secure coding, cloud controls, incident handling, data protection, and professional ethics. Use pretend data, never real passwords or private information. Stop and ask a trusted adult if anything seems unsafe.
REVIEW QUESTIONS: What is the main idea? Why does the first step matter? How would you detect a mistake? What evidence proves the result? What would you improve? Answer in your own words before taking the quiz.
PORTFOLIO REFLECTION: Save a drawing, sanitized screenshot, or short note describing the goal, your approach, your evidence, and one lesson learned. Expected result: An independent demonstration with evidence: Worked notebook, Confusion matrix analysis,

Toy modular-arithmetic exercise, Tradeoff explanation.

Investigate with pictures and choices

A model score is called probability without calibration evidence.

What should you ask?

1. Whether it has enough decimal places
2. Whether the title says AI
3. How the score was validated for that interpretation

Worked reasoning

Answer: How the score was validated for that interpretation. A numeric score is not automatically a well-calibrated probability.

Try a changed example

Compare a claimed 70% group with observed outcomes in a suitable test set.

Picture and meaning matches

Vector: Represents ordered components

Probability: Quantifies a defined event

Remainder: Supports modular arithmetic

Ways to respond

Choose, point, draw, demonstrate, type, speak or use your usual communication tool.

A helper can operate the controls while you choose.

Counting support if useful

Use zero to ten counters or dots. Touch each once. The last count names the quantity. Rearrange the same set and check whether anything was added or removed.

Choose this foundation practice only when it fits the learner goal.

My notes: _____

Hands-on lab

1. Explain the challenge and make a short plan.
2. Compare two detection thresholds using a confusion matrix and explain the operational tradeoff.
3. Test the result and record evidence of your work.
4. Review the safety scenario and describe one improvement.

Finished result: An independent demonstration with evidence: Worked notebook, Confusion matrix analysis, Toy modular-arithmetic exercise, Tradeoff explanation.

Check your understanding

1. Which idea best describes Independent Challenge & Mastery?

A. It has no purpose in this project.

B. A vector is an ordered list of numbers.

C. Apply what you learned without copying the guided solution.

D. A model can estimate uncertainty, but a probability is not a promise.

2. What is the first step in this lab?

A. Review the safety scenario and describe one improvement.

B. Compare two detection thresholds using a confusion matrix and explain the operational tradeoff.

C. Test the result and record evidence of your work.

D. Explain the challenge and make a short plan.

3. What should you do after step two?

A. Test the result and record evidence of your work.

B. Compare two detection thresholds using a confusion matrix and explain the operational tradeoff.

C. Review the safety scenario and describe one improvement.

D. Explain the challenge and make a short plan.

4. Which result shows that your lab is finished?

A. A blank page with no work

B. An independent demonstration with evidence: Worked notebook, Confusion matrix analysis, Toy modular-arithmetic exercise, Tradeoff explanation.

C. A copied answer without checking it

D. A skipped lab

Answer review

1. C. Apply what you learned without copying the guided solution.
2. D. Start with: Explain the challenge and make a short plan.
3. A. Step three is: Test the result and record evidence of your work.
4. B. The goal is: An independent demonstration with evidence: Worked notebook, Confusion matrix analysis, Toy modular-arithmetic exercise, Tradeoff explanation.

Mastery & safe-use plan

Ages 16-17

Digital safety: Apply identity security, social-engineering defense, secure coding, cloud controls, incident handling, data protection, and professional ethics.

AI literacy: Use AI as an accountable engineering assistant: validate outputs, protect data, document use, test security, and keep humans responsible.
Challenge: Work through a realistic ticket, incident, architecture, data, or application scenario with professional evidence.
Portfolio: Produce a career-ready artifact such as a repository, incident report, architecture diagram, dashboard, automation, or technical brief.
Mastery check: Present the work as if to a mentor or interviewer: problem, approach, evidence, tradeoffs, security, and next improvement.

Project worksheet

My project: Explain a model and a simple cipher
Who will use or review it? _____
My plan: _____
Checkpoint 1: A labeled feature plot with a careful comparison.
Checkpoint 2: A small prediction table with accuracy and an error note.
Checkpoint 3: An encoded and decoded sample with a security warning.
Checkpoint 4: A completed guided project with documented evidence: Worked notebook, Confusion matrix analysis, Toy modular-arithmetic exercise, Tradeoff explanation.
Checkpoint 5: An independent demonstration with evidence: Worked notebook, Confusion matrix analysis, Toy modular-arithmetic exercise, Tradeoff explanation.
One thing I tested: _____
One thing I changed after testing: _____
What I learned: _____
Trusted adult or mentor feedback: _____

Family review

Show your finished work to a trusted adult. Explain one thing you learned and one thing you would improve.

Beat IT Kids | For learning at home. Do not put real passwords or private details in practice projects.