

# An Introduction to Public Key Cryptography

TOPIC: FOUNDATIONAL PRINCIPLES OF CYBERSECURITY

GRADES: 6-8, 9-12

LESSON DURATION: TEACHER DISCRETION

SOFT SKILLS: COLLABORATION, COMMUNICATION, PROBLEM SOLVING

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## Learning Outcomes:

- Students will define encryption and understand the necessity of protecting data on the internet.
- Students will complete an activity in which public key cryptography is explained in an easy to understand fashion.
- Students will describe why and when public key cryptography is used.

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## Materials:

- pieces of paper
- paint brushes
- a cup of water
- a paint kit with at least 4 colors.

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## Activities:

1. By grade 6, students should be familiar with the term cryptography. However, it is best to remind them of the definition. This video could be used as a review, [Khan Academy](#). *All Khan Academy content is available for free at [www.khanacademy.org](http://www.khanacademy.org)*
2. Explain that today students will be learning a modern, extremely important type of cryptography called public key cryptography.
3. Students will need a partner, 2 pieces of paper, 2 paint brushes, a cup of water, and a paint kit with at least 4 colors.
4. The teacher should begin by asking students, "When in your daily lives would you need to send an encrypted message?" Some possible answers: parents are banking, shopping online, transferring money to a family member, adding iTunes gift cards to an account, etc.
5. Today we are going to learn one method that is used to make sure that the transfer is reasonably safe.
6. Each partner pair needs to sit beside each other and have the materials listed above. For the sake of simplicity, one partner needs to take on the name "Bob" while one will be "Alice."
7. The partners decide on a mutual color. In this case Bob and Alice decide to use green.
8. Each puts a glob of green paint on their paper.
9. Next each person decides on a private color. Bob chooses red, so he mixes red in with the green. Alice chooses blue, so she mixes blue in with the green. Allow the students time to complete this task.

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10. Bob then hands his paper to Alice and she adds her secret blue to Bob's mixture. Meanwhile, Bob adds red to Alice's mixture. Allow students time to do this.
11. Now both people should have the same color.
12. However, let's say Eve was eavesdropping. She heard the initial colors but didn't hear the secret color. She then sees the result. Because she doesn't know the secret color, she can decode the entire array of colors. The only way she knows that colors are in it is by mixing through trial and error (in cyber this is called a brute force attack). \*No student needs to role play as Eve.
13. This is an analogy for how information is shared online in an encrypted fashion.
14. Re-teach/review the steps that were taken with the paint. The teacher might consider putting the steps on the board/screen so that students can recreate what they did. Allow students time to discuss and ask questions.
15. Although encryption can be far more complex than this method, students now have a basic understanding of public key encryption.

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