# Annex A. Illustrative examples

177. The items included in this Annex illustrate some of the most important new elements of the framework. For the sake of ensuring the preservation of trend, the majority of the items in the PISA 2021 will be items that have been used in previous PISA assessments. A larger set of release items to illustrate the item pool can be found at http://www.oecd.org/pisa/test.

178. The items provided in this annex illustrate some of the following new elements:

- The assessment of mathematical reasoning as described in the framework;
- The four topics that have been identified for special emphasis in the PISA 2021 assessment, growth phenomena; geometric approximations; computer simulations; and conditional decision making;
- The range of item features that are possible on account of the Computer-Based Assessment of Mathematics (CBAM); and
- Computational thinking.

179. The seven illustrative items provided in this annex include:

- **SMARTPHONE USE**: This item illustrates:
  - CBAM capabilities in particular the use of spreadsheets with sorting and other capabilities.
- **THE BEAUTY OF POWERS**: This item illustrates:
  - A range of mathematics reasoning items from simple to more complex in a mathematical context; and
  - Hints at growth phenomena, although, in fairness, the context for this item is more focused on reasoning and pattern recognition than it is on growth.
- **ALWAYS SOMETIMES NEVER**: This item illustrates:
  - A range of reasoning items from simple to more complex including a range of question types from yes/no and multiple choice to open-ended items
- **TILING**: This item illustrates:
  - Reasoning and computational thinking; and
  - Geometric representations.
- **PURCHASING DECISION**: This item illustrates:
  - The application of conditional decision making.
- **NAVIGATION**: This item illustrates:
  - Reasoning in a geometric context; and
  - CBAM capabilities in items.
- **SAVINGS SIMULATION**: This item illustrates:
  - The use a computer simulation; and
  - Hints at growth in the context and impact of interest.

**Smartphone use**

Introduction

*Read the introduction. Then click on the NEXT arrow.*

## SMARTPHONE USE

The spreadsheet shows the population (in millions) and the number of smartphone users (in millions) for a range of countries in Asia. The data has been sorted by country name.

| Column A | Column B | Column C | Column D |
|---|---|---|---|
| **Country** | **Population (in millions)** | **Number of smartphone users (in millions)** | |
| Bangladesh | 166.735 | 8.921 | |
| Indonesia | 266.357 | 67.57 | |
| Japan | 125.738 | 65.282 | |
| Malaysia | 31.571 | 20.98 | |
| Pakistan | 200.663 | 23.228 | |
| Philippines | 105.341 | 28.627 | |
| Thailand | 68.416 | 30.486 | |
| Turkey | 81.086 | 44.771 | |
| Vietnam | 96.357 | 29.043 | |

**Smartphone use**

Question 1/3

*Refer to "Smartphone use" on the right. Click on a choice to answer the question.*

Which operation on columns B and C will determine the correct values in Column D?

For each country:

- ◯ Divide the Column B value by the Column C value:

  B / C

- ◯ Divide the sum of the Column B and Column C values by the Column C value:

  (B + C) / C

- ◯ Divide the Column C value by the Column B value:

  C / B

- ◯ Divide the Column B value by the sum of the Column B and Column C values:

  B / (B + C)

## SMARTPHONE USE

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| Column A | Column B | Column C | Column D |
|---|---|---|---|
| **Country** | **Population (in millions)** | **Number of smartphone users (in millions)** | **Proportion of smartphone users** |
| Bangladesh | 166.735 | 8.921 | |
| Indonesia | 266.357 | 67.57 | |
| Japan | 125.738 | 65.282 | |
| Malaysia | 31.571 | 20.98 | |
| Pakistan | 200.663 | 23.228 | |
| Philippines | 105.341 | 28.627 | |
| Thailand | 68.416 | 30.486 | |
| Turkey | 81.086 | 44.771 | |
| Vietnam | 96.357 | 29.043 | |

**Smartphone use**

Question 2/3

You can sort the data in the spreadsheet by selecting the sort button in the column header. The data will be sorted in ascending order.

Use the sort buttons help you evaluate each statement.

Click on either **True** or **False** for each of the following statements.

| Statement | True | False |
|---|---|---|
| The country with the largest population also has the largest number of smartphone users. | ○ | ○ |
| The country with the fewest number of smartphone users also has the smallest population. | ○ | ○ |
| The country with the highest proportion of smartphone users also has the smallest population. | ○ | ○ |
| The country with the median proportion of smartphone users is also the country with the median number of smartphone users. | ○ | ○ |

## SMARTPHONE USE

The data for the proportion of smartphone users (expressed as a percentage) has been added to the spreadsheet in Column D.

| Column A | Column B | Column C | Column D |
|---|---|---|---|
| **Country** | **Population (in millions)** | **Number of smartphone users (in millions)** | **Proportion of smartphone users** |
| Bangladesh | 166.735 | 8.921 | 5% |
| Indonesia | 266.357 | 67.57 | 25% |
| Japan | 125.738 | 65.282 | 52% |
| Malaysia | 31.571 | 20.98 | 38% |
| Pakistan | 200.663 | 23.228 | 12% |
| Philippines | 105.341 | 28.627 | 27% |
| Thailand | 68.416 | 30.486 | 45% |
| Turkey | 81.086 | 44.771 | 55% |
| Vietnam | 96.357 | 29.043 | 30% |

**Smartphone use**

Question 3/3

You can change the horizontal axis variable between the **Population (in millions)** and the **Minimum hourly wage (in Zeds)** for each country by selecting the corresponding tab.

By selecting the corresponding tabs study the different graphs and answer the question.

For which variable (population or minimum hourly wage) does the proportion of smartphone users in a country increase as the variable value increases?

◯ Population

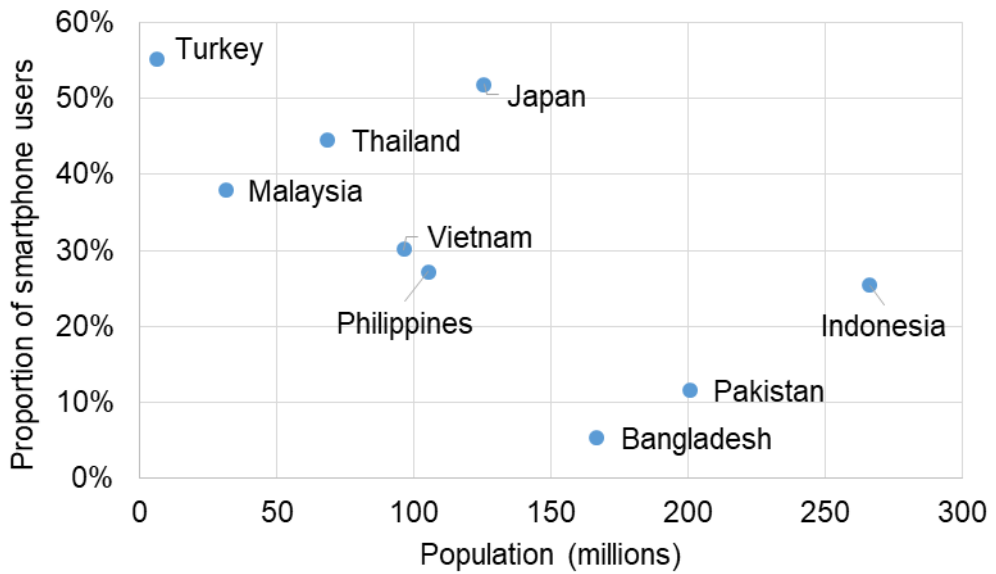
◯ Minimum hourly wage (Zeds)

Explain your reasoning:

## SMARTPHONE USE

The graph plots the proportion of smartphone users per country in terms of either the **Population (in millions)** and the **Minimum hourly wage (in Zeds)** for each country.

Population | Hourly wage



**Smartphone use**

Question 3/3

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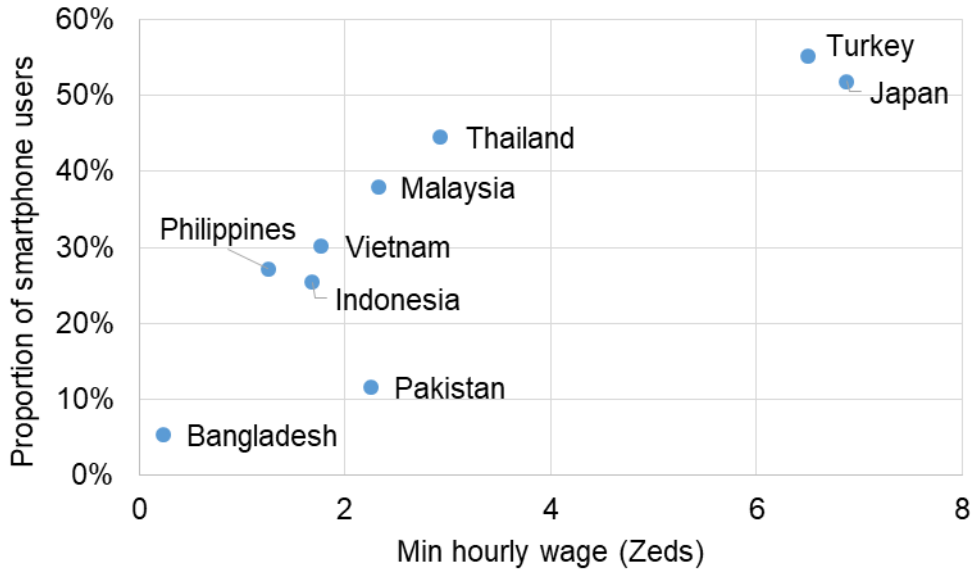

**The beauty of powers**

Introduction

*Read the introduction. Then click on the NEXT arrow.*

## THE BEAUTY OF POWERS

When you perform repeated multiplication with the same number, you can use power notation to summarise what you are doing.

For example:

$8 \times 8 \times 8 \times 8 = 8^4$ (four 8s multiplied together)

and

$7 \times 7 \times 7 \times 7 \times 7 \times 7 = 7^6$ (six 7s multiplied together)

**The beauty of powers**

Question 1/3

*Refer to "The beauty of powers" on the right. Click on either **True** or **False** for each of the statements.*

| Statement | True | False |
|---|---|---|
| The number $8^{16}$ is 8 times larger than the number $8^{15}$ | ○ | ○ |
| The number $8^{10}$ is 10 times larger than the number 8 | ○ | ○ |

## THE BEAUTY OF POWERS

When you perform repeated multiplication with the same number, you can use power notation to summarise what you are doing.

For example:

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and

$$7 \times 7 \times 7 \times 7 \times 7 \times 7 = 7^6$$ (six 7s multiplied together)

**The beauty of powers**

Question 2/3

*Refer to "The beauty of powers" on the right. Click on a choice to answer the question.*

$$(-5)^{43} + (-1)^{43} + (5)^{43}$$

What is the value of the expression above?

- ○ –1
- ○ 1
- ○ 0
- ○ 5

## THE BEAUTY OF POWERS

When you perform repeated multiplication with the same number, you can use power notation to summarise what you are doing.

For example:

$8 \times 8 \times 8 \times 8 = 8^4$ (four 8s multiplied together)

and

$7 \times 7 \times 7 \times 7 \times 7 \times 7 = 7^6$ (six 7s multiplied together)

**The beauty of powers**

Question 3/3

*Refer to "The beauty of powers" on the right. Click on a choice to answer the question.*

What is the last digit of the number $7^{190}$?

- ○ 1
- ○ 3
- ○ 7
- ○ 9

## THE BEAUTY OF POWERS

The first nine powers of the number 7 are listed below.

Notice how fast they grow!

The last digits of these numbers follow a rule or pattern. Study the pattern to answer the question.

$7^1 =$ 7
$7^2 =$ 49
$7^3 =$ 343
$7^4 =$ 2 401
$7^5 =$ 16 807
$7^6 =$ 117 649
$7^7 =$ 823 543
$7^8 =$ 5 764 801
$7^9 =$ 40 353 607

## ALWAYS SOMETIMES NEVER

**Always sometimes never**

Introduction

*Read the introduction. Then click on the NEXT arrow.*

## ALWAYS SOMETIMES NEVER

Statements that people make can generally be grouped into three different categories:

Statements that are **ALWAYS** true;
Statements that are **SOMETIMES** true; and
Statements that are **NEVER** true.

The statement:

”*A number that is divisible by 4 is also divisible by 2*”

is **ALWAYS** true because 2 is a factor of 4.

The statement:

”*A number that is divisible by 9 is also divisible by 6*”

is **SOMETIMES** true. For example, 36 is divisible by 9 and by 6, but 27 is divisible by 9, but not divisible by 6.

The statement:

”*The sum of two odd numbers is odd*”

is **NEVER** true because the sum of two odd numbers is always even.

**Always sometimes never**

Question 1/3

For each statement, indicate if it is **always true**, **sometimes true** or **never true**

| Statement | Always True | Sometimes True | Never True |
|---|---|---|---|
| A 14-year old girl was at least once in her life half her current height. | ○ | ○ | ○ |
| A 14-year old girl is taller than a 10-year old girl. | ○ | ○ | ○ |

## ALWAYS SOMETIMES NEVER

Statements that people make can generally be grouped into three different categories:

Statements that are **ALWAYS** true;
Statements that are **SOMETIMES** true; and
Statements that are **NEVER** true.

The statement:

”*A number that is divisible by 4 is also divisible by 2*”

is **ALWAYS** true because 2 is a factor of 4.

The statement:

”*A number that is divisible by 9 is also divisible by 6*”

is **SOMETIMES** true. For example, 36 is divisible by 9 and by 6, but 27 is divisible by 9, but not divisible by 6.

The statement:

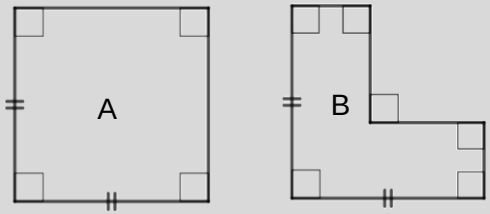
”*The sum of two odd numbers is odd*”

is **NEVER** true because the sum of two odd numbers is always even.

**Always sometimes never**

Question 2/3

For each statement, indicate if it is **always true**, **sometimes true** or **never true**

| Statement | Always True | Sometimes True | Never True |
|---|---|---|---|
| When a whole number is multiplied by itself the answer is even. | ○ | ○ | ○ |
| Doubling a whole number produces an even number. | ○ | ○ | ○ |
| Halving an odd whole number produces a whole number | ○ | ○ | ○ |
| $3x + 1 = \frac{6x + 2}{2}$ | ○ | ○ | ○ |
|   The perimeter of figure A is greater than the perimeter of figure B. | ○ | ○ | ○ |
| If a coin is flipped 50 times it will land heads up 25 times. | ○ | ○ | ○ |

**Always sometimes never**

Question 3/3

Each of the following statement is **SOMETIMES TRUE**.

For each statement provide an example of when the statement is true and when the statement is not true.

| Statement | Example of when the statement is true | Example of when the statement is not true |
|---|---|---|
| The person with the largest number of coins has the largest amount of money. | *Enter your example here* | *Enter your example here* |
| A – B = B – A | *Enter your example here* | *Enter your example here* |
| If you add the same number to the numerator (top) and the denominator (bottom) of a fraction, the fraction value increases. | *Enter your example here* | *Enter your example here* |

## TILING

**Tiling**

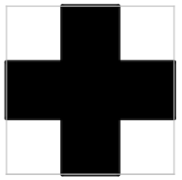
Introduction

*Read the introduction. Then click on the NEXT arrow*

## TILING

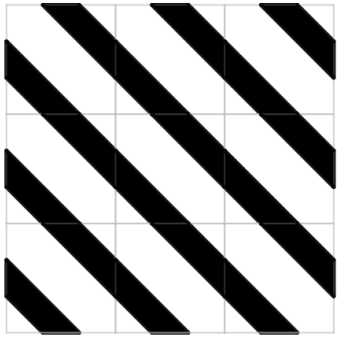
A tiler is tiling the floor. He has two different tiles that he can use, tile A and tile B.

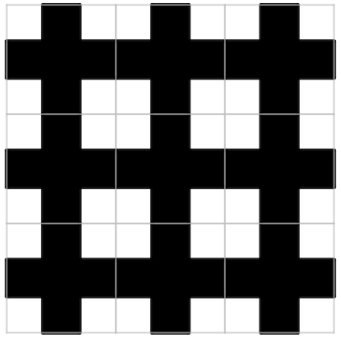
Tile A



Tile B

Using only tile A he makes the left hand pattern below and using only tile B he makes the right hand pattern below.





**Tiling**

Question 1/5

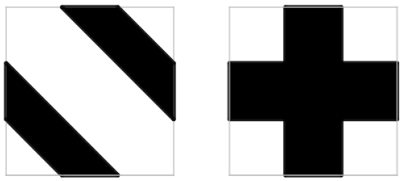
*Refer to "tiling" on the right. Use drag-and-drop to complete the problem.*

The tiling pattern on the right is created using a combination of the two tiles. The tiler continues to tile the floor by extending the pattern in the same way.

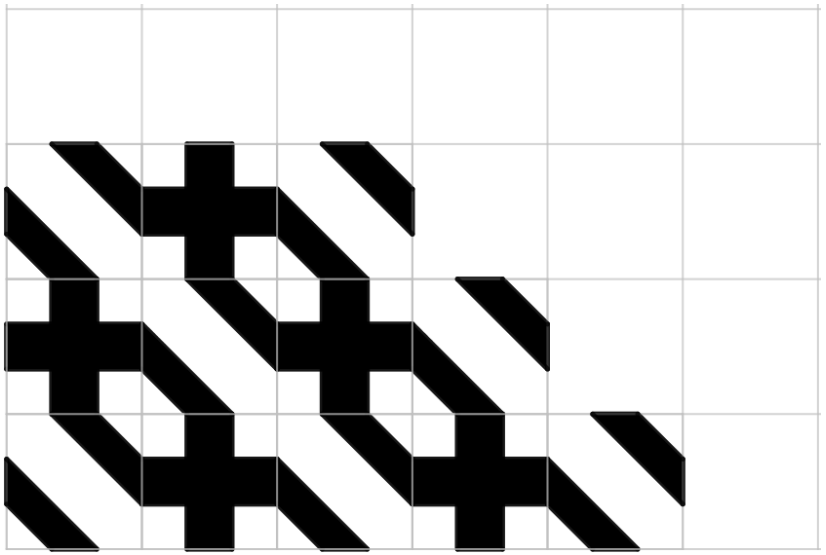
Study the pattern.

Use your mouse to drag and drop the tiles into position and finish tiling the rest of the floor using the same pattern.

**TILING**



Tile A Tile B



**Tiling**

Question 2/5

*Refer to "tiling" on the right. Use drag-and-drop to complete the problem.*

The tiler wants to make a set of instructions that he can give to people who want to make the same tiling pattern.

Drag and drop the elements into the spaces to complete the instructions that will produce the pattern on the right.

IF THEN ELSE TILE A TILE B

TILING INSTRUCTIONS

For row = 1 to 4

*"First determine the left hand tile in the row"*

IF the row is an odd numbered row

THEN the first tile is ____

ELSE the first tile is ____

*"Complete the row by adding tiles"*

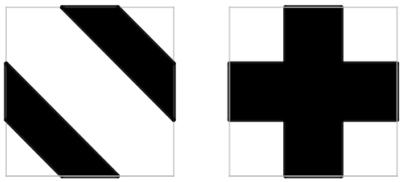
IF the previous tile is ____

____ use ____

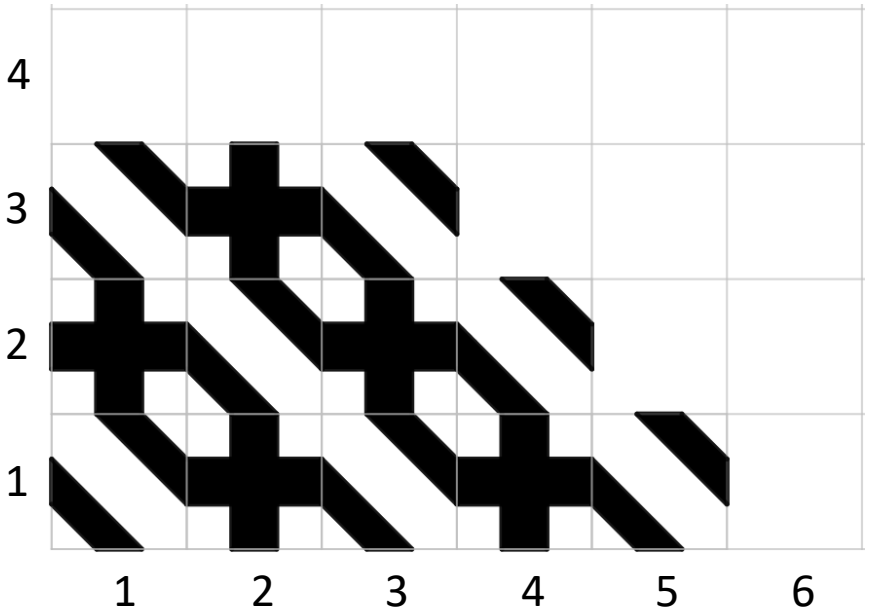
____ use ____

Next row

**TILING**



Tile A Tile B



**Tiling**

Question 3/5

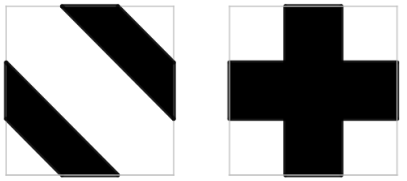
*Refer to "tiling" on the right. Click on the choices to answer the question.*

The tiler wants to be able to predict what tile will go in any position on the grid. For example, he wants to know what tile he will use in the marked position (*m*; *n*).

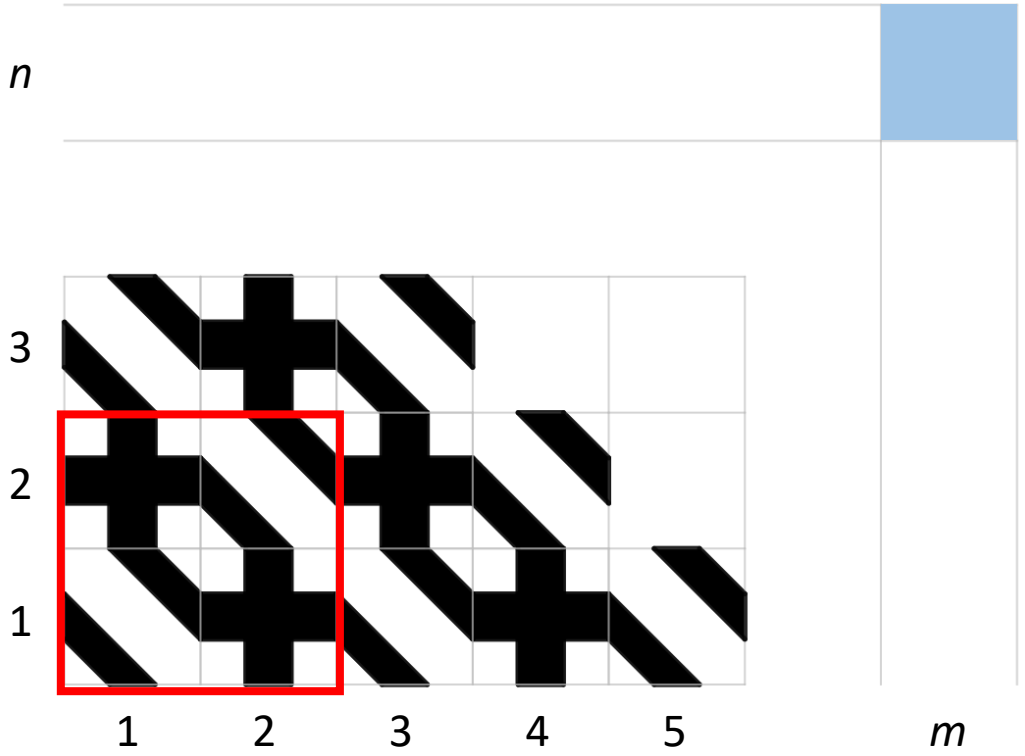
Study the tiling pattern and in particular the four tiles highlighted with a red border. Select **ALL** of the rules below that will correctly predict the tile that is needed for any grid position (*m*; *n*).

| Rule | |
|---|---|
| If *m* + *n* is odd use tile A, otherwise use tile B | ○ |
| If *m* + *n* is even use tile A, otherwise use tile B | ○ |
| If *m* × *n* is odd use tile A, otherwise use tile B | ○ |
| If *m* × *n* is even use tile A, otherwise use tile B | ○ |
| If *m* is odd and *n* is odd use tile A, otherwise use tile B | ○ |
| If *m* and *n* are both odd or both even use tile A, otherwise use tile B | ○ |

**TILING**



Tile A Tile B



**Tiling**

Discussion

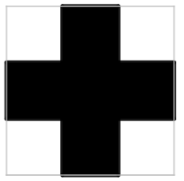
*Read the introduction*

Another way of describing the pattern is to simply write the letters for each tile in the corresponding grid position.

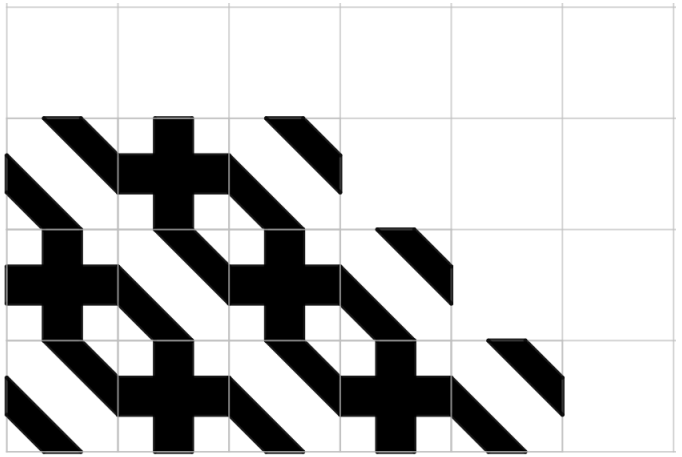
Study the use of letters to record the tiling pattern. Then click on the NEXT arrow.

**TILING**

Tile A



Tile B



| | | | | | |
|---|---|---|---|---|---|
| | | | | | |
| A | B | A | | | |
| B | A | B | A | | |
| A | B | A | B | A | |

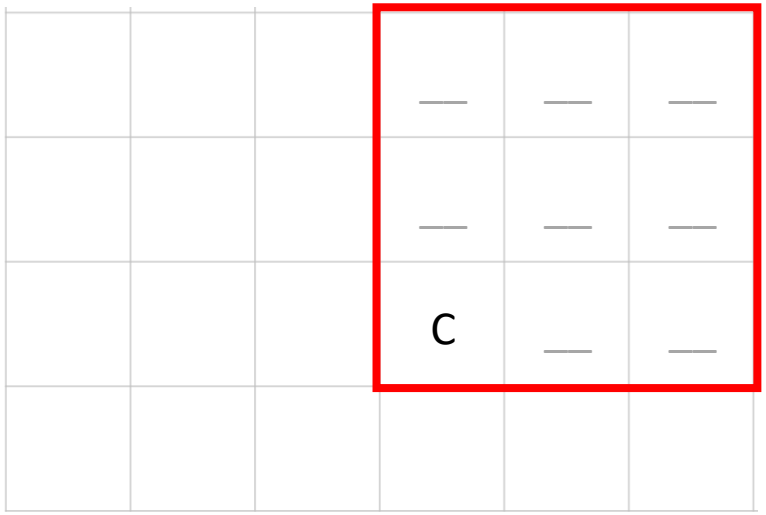
**Tiling**

Question 4/5

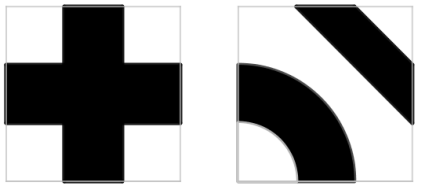
The tiling pattern on the right is created using a combination of two tiles: B and C. Ameer continues to tile the floor by extending the pattern in the same way.

Study the pattern.

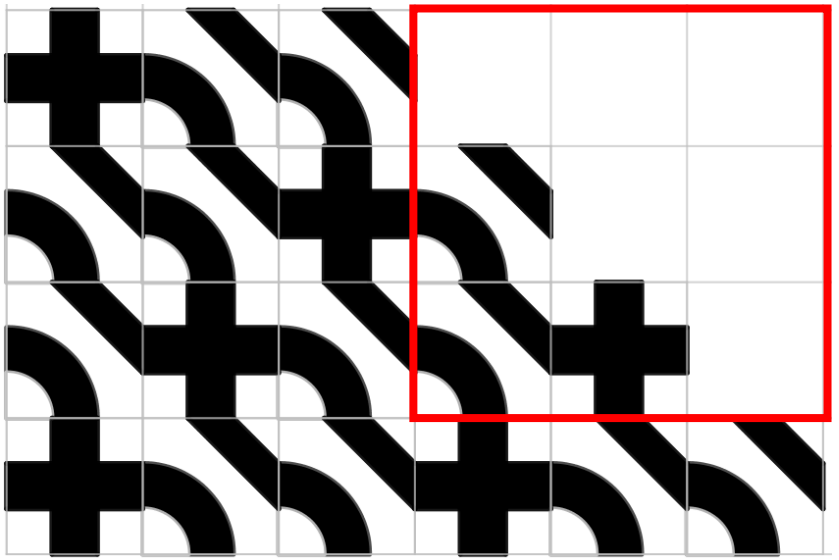
The red square on the grid below corresponds to the red square on the grid on the right. Use the letters B and C to record the tile that goes in each position of the red square.




**TILING**



Tile B Tile C



**Tiling**

Question 5/5

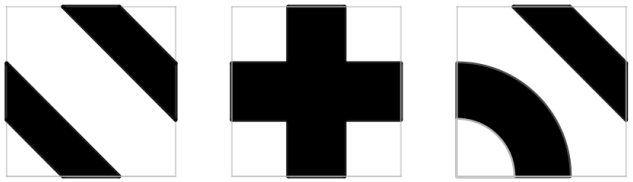
The tiling pattern on the right is a section from the middle of a much larger area created using a combination of three tiles: A, B and C.

Study the pattern.

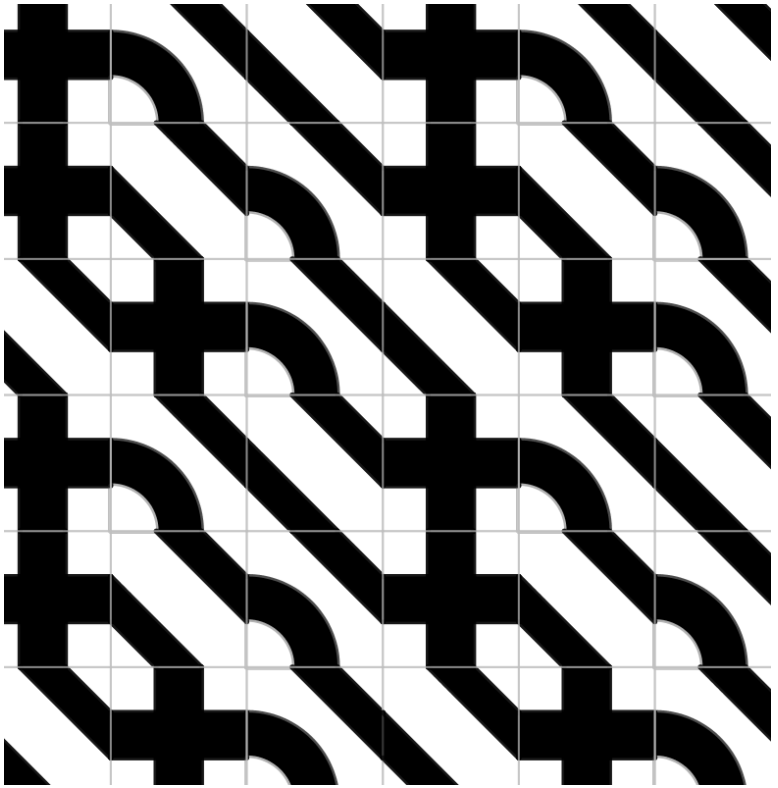
Which of the codes below describes a 3 x 3 unit of tiles that can be repeated to create the pattern on the right (select **ALL** that apply).

| 3 x 3 unit used to create the pattern | |
|---|---|
| A B C<br>B A C<br>B C A | ○ |
| B C A<br>C A B<br>A C B | ○ |
| A B C<br>B C A<br>B A C | ○ |
| A B C<br>B C A<br>C A B | ○ |

**TILING**



Tile A Tile B Tile C



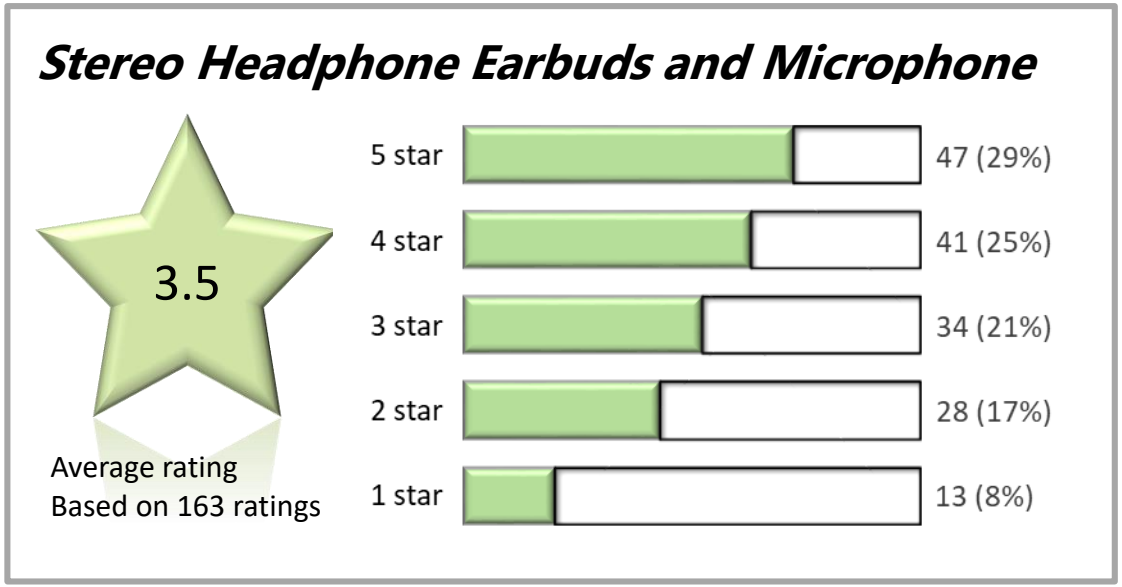
**Purchasing decision**

Introduction

*Read the introduction. Then click on the NEXT arrow.*

## PURCHASING DECISION

Andrea is shopping online for a new pair of headphones. She has identified a pair that she likes. However, she notices that even though the total number of reviews is small, the product received many poor reviews: a total of 25% 1- and 2-star reviews.




**Purchasing decision**

Introduction continued

*Read the extended introduction. Then click on the NEXT arrow.*

## PURCHASING DECISION

To help with her decision to buy the product or not, Andrea studied the comments for the 1- and 2-star reviews and noticed that some of the reviews have nothing to do with the quality or the functioning of the product.

She grouped the responses for the 1- and 2-star reviews and summarised her findings in the table.

| REASON | Number |
|---|---|
| Headphones arrived late | 13 |
| Headphones did not arrive at all | 4 |
| Cable was damaged or missing | 7 |
| One or both earbuds were broken | 4 |
| Packaging was unattractive | 5 |
| Wrong rating (good review, bad rating) | 8 |

**Purchasing decision**

Question 1/2

**Andrea looked through all the reviewers comments and noticed that only the 1- and 2-star reviewers made comments about poor quality or about the product arriving late or not at all.**

Use the information from the **Online reviews** tab and from the **Summary table** tab as well as the built in calculator to answer the questions.

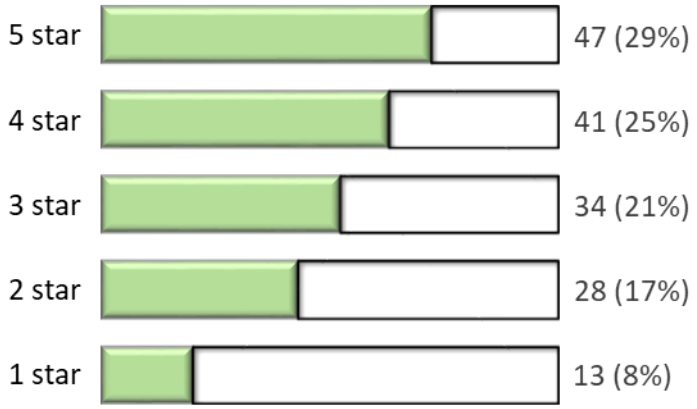
| Question | Response |
|---|---|
| What percentage of all of the reviews deal with poor quality of the product? | |
| What percentage of the 1- and 2-star reviews deal with the product arriving late or not at all? | |

## PURCHASING DECISION

Online reviews | Summary table

### *Stereo Headphone Earbuds and Microphone*


Average rating
Based on 163 ratings




**Purchasing decision**

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## PURCHASING DECISION

Online reviews | Summary table

| REASON | Number |
|---|---|
| Headphones arrived late | 13 |
| Headphones did not arrive at all | 4 |
| Cable was damaged or missing | 7 |
| One or both earbuds were broken | 4 |
| Packaging was unattractive | 5 |
| Wrong rating (good review, bad rating) | 8 |

**Purchasing decision**

Question 2/2

**Andrea looked through all the reviewers comments and noticed that only the 1- and 2-star reviewers made comments about poor quality or about the product arriving late or not at all.**

Use the information from the **Online reviews** tab and from the **Summary table** tab as well as the built in calculator to answer the question.

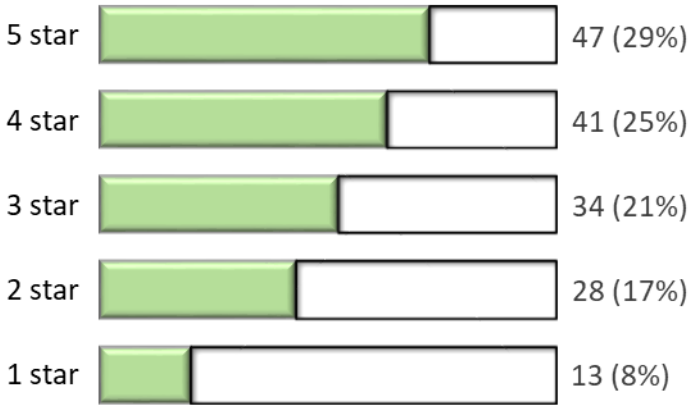
| Question | Response |
|---|---|
| Andrea is concerned about the headphones arriving late or not at all.<br><br>Based on the information in the **Online reviews** tab and the **Summary table**. How likely is it that the product will arrive late or not at all?<br><br>**Express your answer as a fraction or percentage.** | |

## PURCHASING DECISION

Online reviews | Summary table

### *Stereo Headphone Earbuds and Microphone*


Average rating
Based on 163 ratings




**Purchasing decision**

Question 2/2

**Andrea looked through all the reviewers comments and noticed that only the 1- and 2-star reviewers made comments about poor quality or about the product arriving late or not at all.**

Use the information from the **Online reviews** tab and from the **Summary table** tab as well as the built in calculator to answer the question.

| Question | Response |
|---|---|
| Andrea is concerned about the headphones arriving late or not at all.<br><br>Based on the information in the **Online reviews** tab and the **Summary table**. How likely is it that the product will arrive late or not at all?<br><br>**Express your answer as a fraction or percentage.** | |

## PURCHASING DECISION

Online reviews | Summary table

| REASON | Number |
|---|---|
| Headphones arrived late | 13 |
| Headphones did not arrive at all | 4 |
| Cable was damaged or missing | 7 |
| One or both earbuds were broken | 4 |
| Packaging was unattractive | 5 |
| Wrong rating (good review, bad rating) | 8 |

## NAVIGATION

**Navigation**

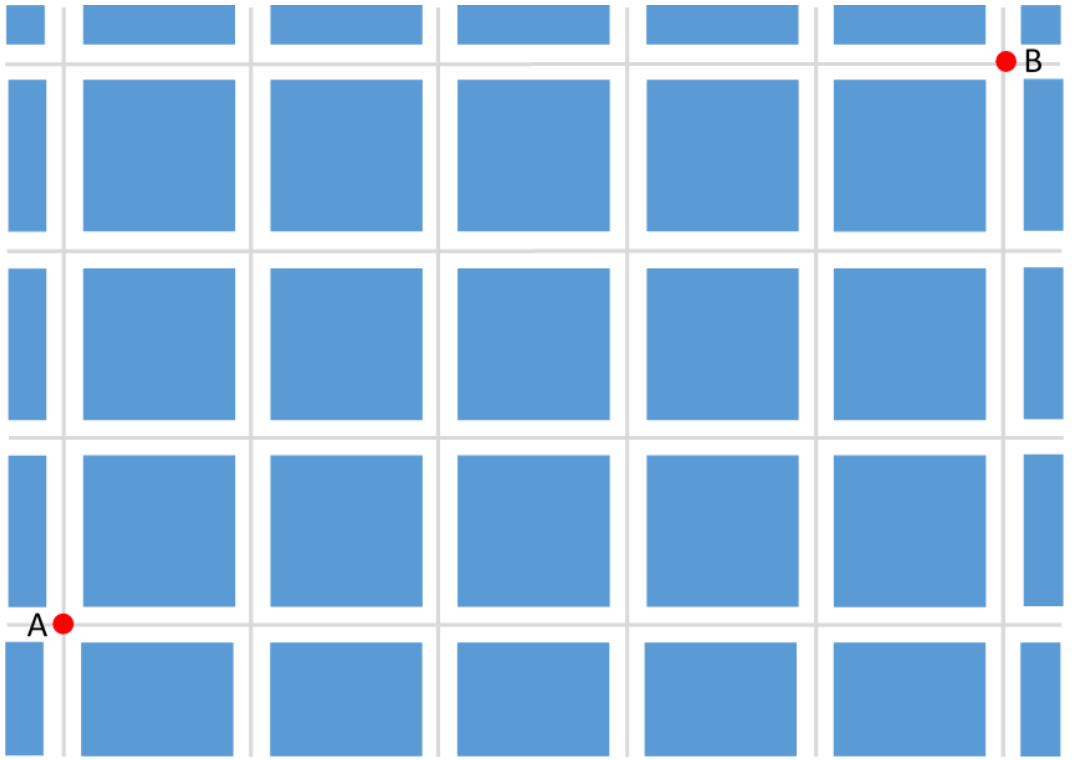
Introduction

*Read the introduction. Then click on the NEXT arrow.*

## NAVIGATION

The shortest distance between two points is a straight line. It is, however not usually possible to navigate along a straight line in a town. Look at the map below. The grey lines are the roads and the square blue blocks are the buildings.

In this unit you will explore different strategies for planning a route from one point to another in this town.



**Navigation**

Introduction continued

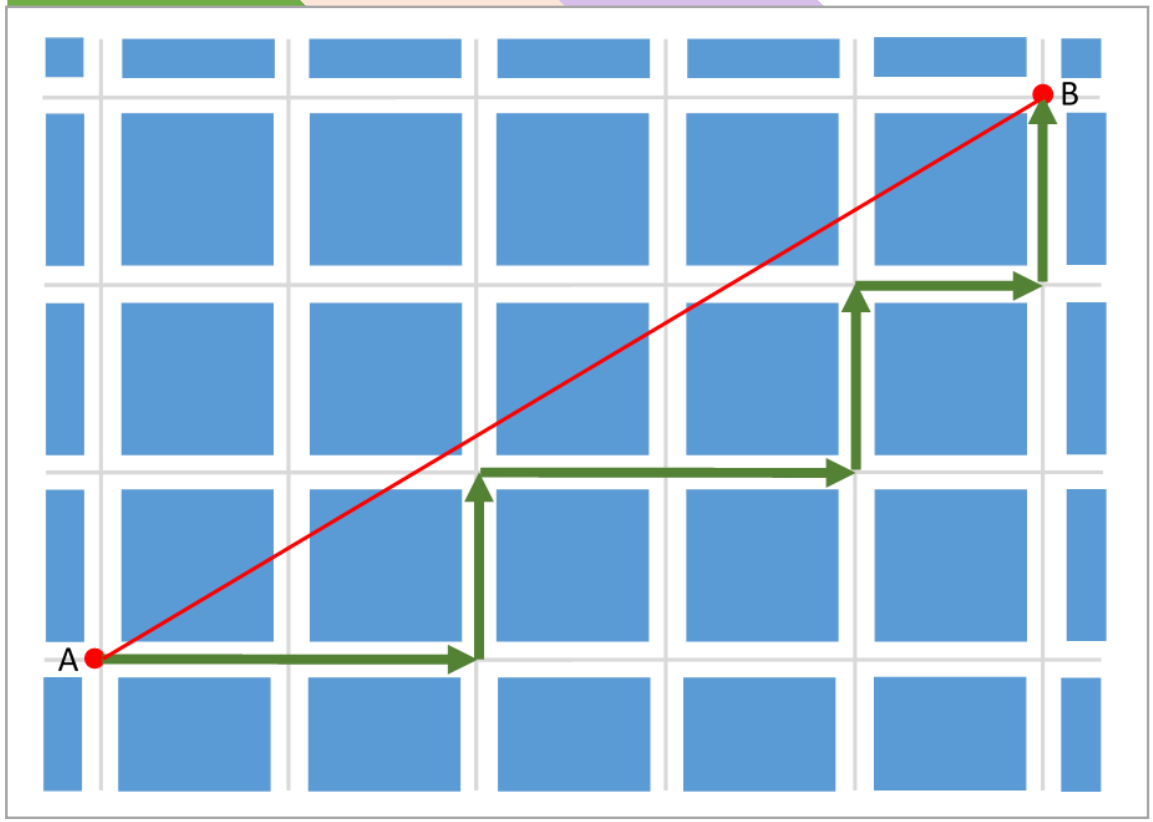
*Read the introduction and select the different tabs to see the different routes. Then click on the NEXT arrow.*

## NAVIGATION

Ann, Bob and Corey have different ideas about how to determine the shortest route from A to B.

- Ann always moves right or up and stays below but as close as possible to the straight red line joining A and B (green line).
- Bob always moves right or up and tries to cross the straight red line joining A and B as often as possible (orange line).
- Corey always moves right or up and stays above but as close as possible to the straight red line joining A and B (purple line).

Ann's route | Bob's route | Corey's route



**Navigation**

Introduction continued

*Read the introduction and select the different tabs to see the different routes. Then click on the NEXT arrow.*

## NAVIGATION

Ann, Bob and Corey have different ideas about how to determine the shortest route from A to B.

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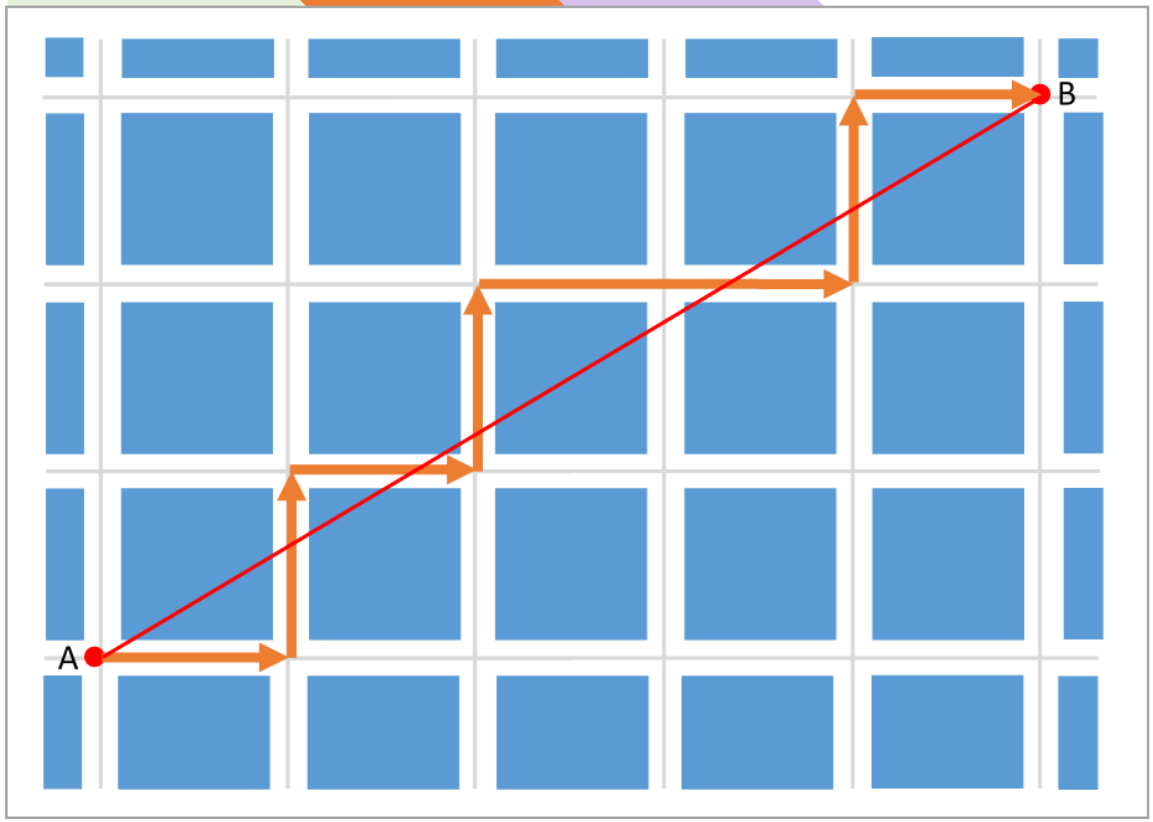
Ann's route | Bob's route | Corey's route



**Navigation**

Introduction continued

*Read the introduction and select the different tabs to see the different routes. Then click on the NEXT arrow.*

## NAVIGATION

Ann, Bob and Corey have different ideas about how to determine the shortest route from A to B.

- Ann always moves right or up and stays below but as close as possible to the straight red line joining A and B (green line).
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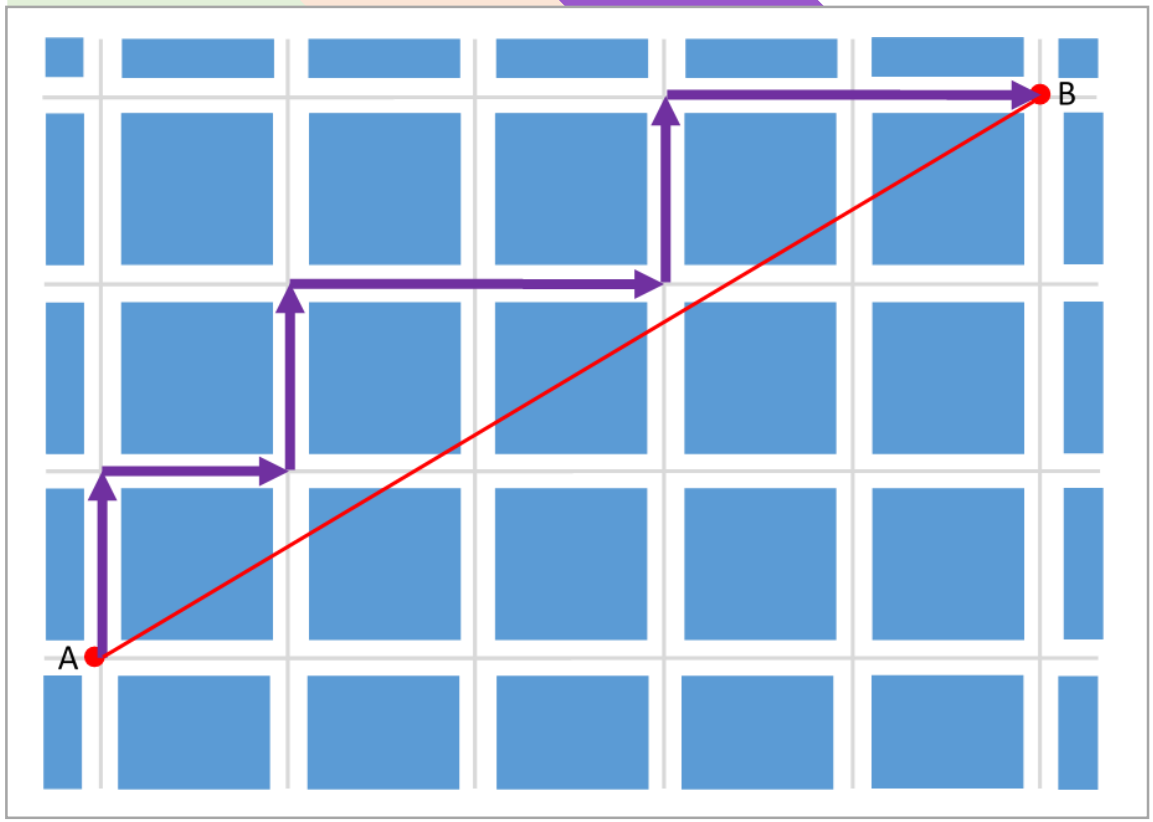
- Corey always moves right or up and stays above but as close as possible to the straight red line joining A and B (purple line).

Ann's route | Bob's route | Corey's route



**Navigation**

Question 1/2

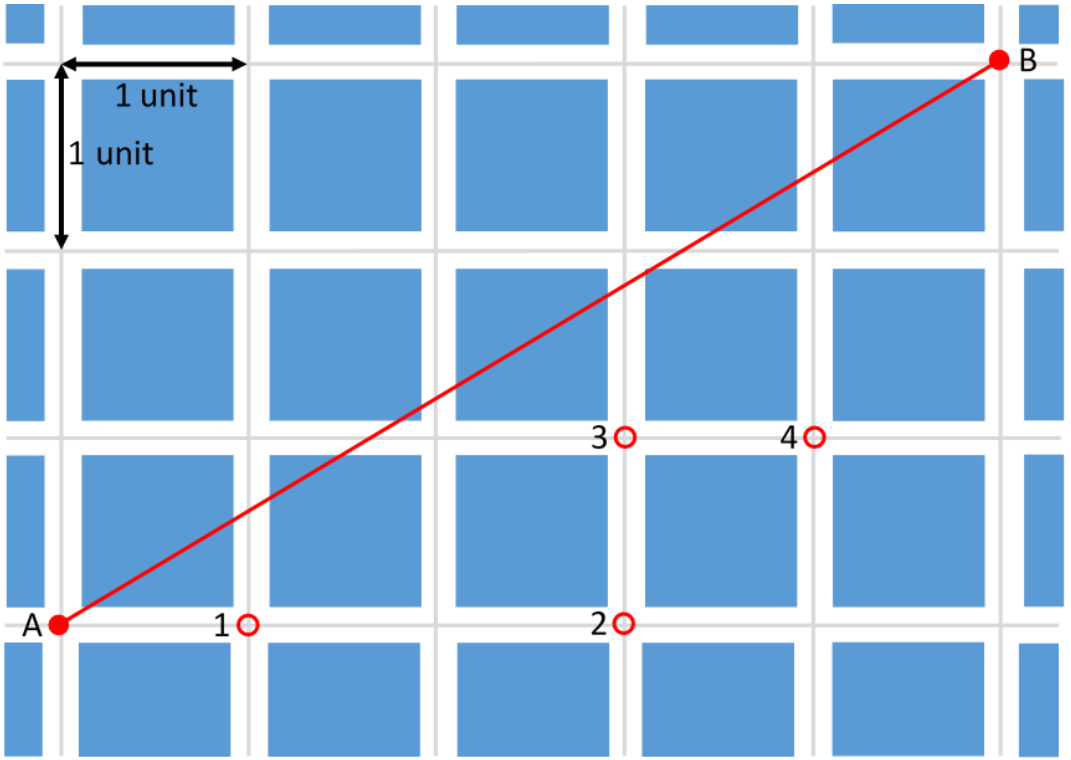
Use your mouse to move point A onto the different marked intersections of the roads – for each position of A, the route for each strategy for getting to B is shown and the distance recorded in the table.

You will notice that the irrespective of the starting position, Ann's route, Bob's route and Corey's route are all the same length for each route from A to B.

**Explain why all three strategies produce routes that are equal in length.**

*Provide an explanation*

**NAVIGATION**




| Position of A | Distance from A to B (in units) | | |
|---|---|---|---|
| | Ann's route | Bob's route | Corey's route |
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

**Navigation**

Question 2/2

Three diagonal streets have been added to the map.

We know from the earlier work that without the diagonal streets the shortest route from point C to point B will be 7 units long.

Click on either **True** or **False** for each of the statements and provide a reason for your answer.

1. There exists a route from C to B that includes Diagonal 1 and is shorter than 7 units.

○ True
○ False

*Provide a reason for your answer*

2 There exists a route from C to B that includes Diagonal 2 and is shorter than 7 units.

○ True
○ False

*Provide a reason for your answer*

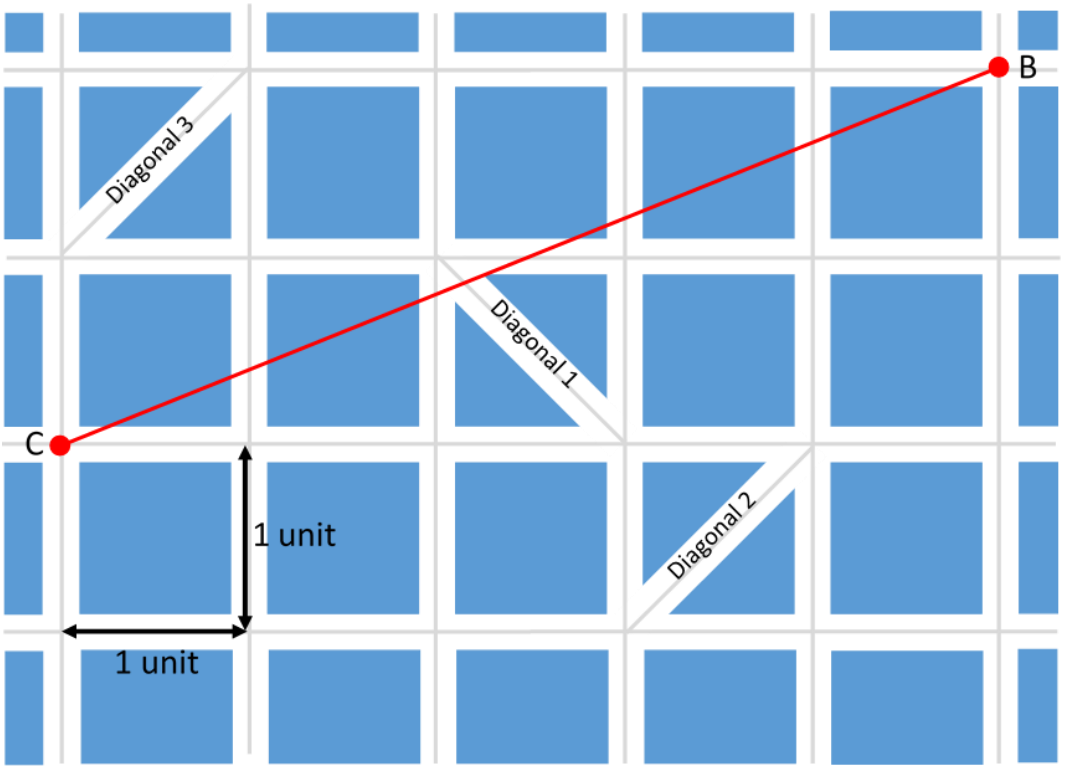
3. There exists a route from C to B that includes Diagonal 3 and is shorter than 7 units.

○ True
○ False

*Provide a reason for your answer*

**NAVIGATION**

Three diagonal streets have been added to the map.



## SAVINGS SIMULATION

**Savings simulation**

Introduction

*Read the introduction. Then click on the NEXT arrow.*

## SAVINGS SIMULATION

Sizwe and her parents are discussing how best to save money to support her expenses when she starts college. They have identified an online saving simulation application that allows them to explore different ways in which they can achieve the outcome they require.

The simulation considers four variables:

- **Monthly deposit**: the amount of money that the family deposits into the savings account every month;
- **Savings period**: the number of months for which the family makes a monthly deposit into the savings account;
- The **annual interest rate** that the savings account attracts; and
- **Total savings**: the total amount that will be saved at the end of the savings period.

The application allows the user to perform three simulations:

- **Total savings**: the total savings that will accumulate if the monthly deposit, interest rate and savings period are known;
- **Monthly deposit**: the monthly deposit that is needed to achieve a desired total savings over a given time period and interest rate; and
- **Savings period**: the total period (number of months) that is needed to achieve a desired total savings for a given monthly deposit and interest rate.

## Savings simulation

Introduction

*Using the simulator involves two steps:*

1. *Selecting the what you want to simulate; and*

2. *Entering the values of the relevant variables.*

*The simulator allows you to save the details for up to five simulations at a time.*

*Explore the way that the simulator works then click on the NEXT arrow.*

**SAVINGS SIMULATOR**

**Step 1: Select what you want to simulate:** Select what you want to simulate:

Step 2: Complete the required information using the highlighted (red) sliders:

| | | |
|---|---|---|
| Savings period: | 0 | Months |
| Monthly deposit: | 0 | Zeds |
| Annual interest rate: | 0 | % per year |
| Total saving: | 0 | Zeds |

Save the data | Clear the saved data

| Simulation # | Savings Period (Months) | Monthly deposit (Zeds) | Annual Interest Rate (%) | Total amount saved (Zeds) |
|---|---|---|---|---|
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |

## Savings simulation

Introduction

*Using the simulator involves two steps:*

1. *Selecting the what you want to simulate; and*

2. *Entering the values of the relevant variables.*

*The simulator allows you to save the details for up to five simulations at a time.*

*Explore the way that the simulator works then click on the NEXT arrow.*

This screen does not appear in the unit. It is provided here to give the reader a sense of what the student will experience.

**SAVINGS SIMULATOR**

Step 1: Select what you want to simulate: The total amount you will save

**Step 2: Complete the required information using the highlighted (red) sliders:**

| | | |
|---|---|---|
| Savings period: | 48 | Months |
| Monthly deposit: | 40 | Zeds |
| Annual interest rate: | 10 | % per year |
| Total saving: | 2350 | Zeds |

Save the data | Clear the saved data

| Simulation # | Savings Period (Months) | Monthly deposit (Zeds) | Annual Interest Rate (%) | Total amount saved (Zeds) |
|---|---|---|---|---|
| 1 | 12 | 40 | 6 | 495 |
| 2 | 48 | 40 | 6 | 2165 |
| 3 | 12 | 40 | 10 | 505 |
| 4 | 48 | 40 | 10 | 2350 |
| 5 | | | | |

## Savings simulation

Introduction

*Using the simulator involves two steps:*

1. *Selecting the what you want to simulate; and*

2. *Entering the values of the relevant variables.*

*The simulator allows you to save the details for up to five simulations at a time.*

*Explore the way that the simulator works then click on the NEXT arrow.*

This screen does not appear in the unit. It is provided here to give the reader a sense of what the student will experience.

### SAVINGS SIMULATOR

Step 1: Select what you want to simulate: The monthly payment you should make

**Step 2: Complete the required information using the highlighted (red) sliders:**

| | | |
|---|---|---|
| Savings period: | 48 | Months |
| Monthly deposit: | 82 | Zeds |
| Annual interest rate: | 12 | % per year |
| Total saving: | 5000 | Zeds |

Save the data | Clear the saved data

| Simulation # | Savings Period (Months) | Monthly deposit (Zeds) | Annual Interest Rate (%) | Total amount saved (Zeds) |
|---|---|---|---|---|
| 1 | 12 | 405 | 6 | 5000 |
| 2 | 48 | 92 | 6 | 5000 |
| 3 | 18 | 255 | 12 | 5000 |
| 4 | 48 | 82 | 12 | 5000 |
| 5 | | | | |

## Savings simulation

Introduction

*Using the simulator involves two steps:*

1. *Selecting the what you want to simulate; and*

2. *Entering the values of the relevant variables.*

*The simulator allows you to save the details for up to five simulations at a time.*

*Explore the way that the simulator works then click on the NEXT arrow.*

This screen does not appear in the unit. It is provided here to give the reader a sense of what the student will experience.

### SAVINGS SIMULATOR

Step 1: Select what you want to simulate: How long it will take you to save an amount

**Step 2: Complete the required information using the highlighted (red) sliders:**

| | | |
|---|---|---|
| Savings period: | 49 | Months |
| Monthly deposit: | 80 | Zeds |
| Annual interest rate: | 12 | % per year |
| Total saving: | 5000 | Zeds |

Save the data | Clear the saved data

| Simulation # | Savings Period (Months) | Monthly deposit (Zeds) | Annual Interest Rate (%) | Total amount saved (Zeds) |
|---|---|---|---|---|
| 1 | 97 | 40 | 6 | 5000 |
| 2 | 55 | 80 | 6 | 5000 |
| 3 | 81 | 40 | 12 | 5000 |
| 4 | 49 | 80 | 12 | 5000 |
| 5 | | | | |

## Savings simulation

Question 1/3

Use the simulator to calculate the unknown amount in each situation.

1. How many Zeds will Sizwe save altogether if she:
   - Deposits 60 Zeds per month,
   - For a period of 48 months,
   - At an annual interest rate of 4%.

   *Enter your answer here*

2. How many Zeds must Sizwe deposit every month if she:
   - Wants to save 4,000 Zeds,
   - Over a period of 36 months,
   - At an annual interest rate of 8%.

   *Enter your answer here*

3. How long (in months) will it take Sizwe to:
   - Save 6000 Zeds,
   - If she deposits 100 Zeds per month,
   - At an annual interest rate of 10%.

   *Enter your answer here*

**SAVINGS SIMULATOR**

**Step 1: Select what you want to simulate:** Select what you want to simulate:

Step 2: Complete the required information using the highlighted (red) sliders:

| | | |
|---|---|---|
| Savings period: | 0 | Months |
| Monthly deposit: | 0 | Zeds |
| Annual interest rate: | 0 | % per year |
| Total saving: | 0 | Zeds |

Save the data | Clear the saved data

| Simulation # | Savings Period (Months) | Monthly deposit (Zeds) | Annual Interest Rate (%) | Total amount saved (Zeds) |
|---|---|---|---|---|
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |

**Savings simulation**

Question 2/3

For each simulation select **TWO STATEMENTS** to justify the use of the given simulator.

| | Statement | | |
|---|---|---|---|
| Simulation | You know how much money you will need | You know how much money you can save each month | You know when you will need the money |
| Savings period simulation | ○ | ○ | ○ |
| Monthly deposit simulation. | ○ | ○ | ○ |
| Total savings simulation | ○ | ○ | ○ |

**SAVINGS SIMULATOR**

**Step 1: Select what you want to simulate:** Select what you want to simulate:

Step 2: Complete the required information using the highlighted (red) sliders:

| | | |
|---|---|---|
| Savings period: | 0 | Months |
| Monthly deposit: | 0 | Zeds |
| Annual interest rate: | 0 | % per year |
| Total saving: | 0 | Zeds |

Save the data | Clear the saved data

| Simulation # | Savings Period (Months) | Monthly deposit (Zeds) | Annual Interest Rate (%) | Total amount saved (Zeds) |
|---|---|---|---|---|
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |

## Savings simulation

Question 3/3

Sizwe has done some simulations, She says: "***I notice than when I earn no interest and double the monthly deposit, the length of the savings period is halved. But, when I earn interest and double the monthly deposit the savings period is not halved***."

*Select the appropriate tabs to study the records in Sizwe's simulation and to do your own simulations to answer the questions.*

1. Complete the statement:

   *Sizwe's observation is*:

   ○ always true
   ○ sometimes true, it depends on the interest rate

2. Complete the statement:

   *For a fixed total savings and a set monthly deposit, an increase in the interest rate reduces the length of the savings period more when*:

   ○ the monthly payment is smaller.
   ○ the monthly payment is larger.

3. Provide a justification for the statement you completed in question 2.

*Provide a justification*

Sizwe's simulator | Blank simulator

**SAVINGS SIMULATOR**

Step 1: Select what you want to simulate: How long it will take you to save an amount

**Step 2: Complete the required information using the highlighted (red) sliders:**

| | | |
|---|---|---|
| Savings period: | 112 | Months |
| Monthly deposit: | 40 | Zeds |
| Annual interest rate: | 6 | % per year |
| Total saving: | 6000 | Zeds |

Save the data | Clear the saved data

| Simulation # | Savings Period (Months) | Monthly deposit (Zeds) | Annual Interest Rate (%) | Total amount saved (Zeds) |
|---|---|---|---|---|
| 1 | 300 | 20 | 0 | 6000 |
| 2 | 150 | 40 | 0 | 6000 |
| 3 | 184 | 20 | 6 | 6000 |
| 4 | 112 | 40 | 6 | 6000 |
| 5 | | | | |

## Savings simulation

Question 3/3

Sizwe has done some simulations, She says: "***I notice than when I earn no interest and double the monthly deposit, the length of the savings period is halved. But, when I earn interest and double the monthly deposit the savings period is not halved***."

*Select the appropriate tabs to study the records in Sizwe's simulation and to do your own simulations to answer the questions.*

1. Complete the statement:

   *Sizwe's observation is*:

   ○ always true
   ○ sometimes true, it depends on the interest rate

2. Complete the statement:

   *For a fixed total savings and a set monthly deposit, an increase in the interest rate reduces the length of the savings period more when*:

   ○ the monthly payment is smaller.
   ○ the monthly payment is larger.

3. Provide a justification for the statement you completed in question 2.

*Provide a justification*

Sizwe's simulator | Blank simulator

**SAVINGS SIMULATOR**

**Step 1: Select what you want to simulate:** Select what you want to simulate:

Step 2: Complete the required information using the highlighted (red) sliders:

| | | | |
|---|---|---|---|
| Savings period: | 0 | Months |
| Monthly deposit: | 0 | Zeds |
| Annual interest rate: | 0 | % per year |
| Total saving: | 0 | Zeds |

Save the data | Clear the saved data

| Simulation # | Savings Period (Months) | Monthly deposit (Zeds) | Annual Interest Rate (%) | Total amount saved (Zeds) |
|---|---|---|---|---|
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |