

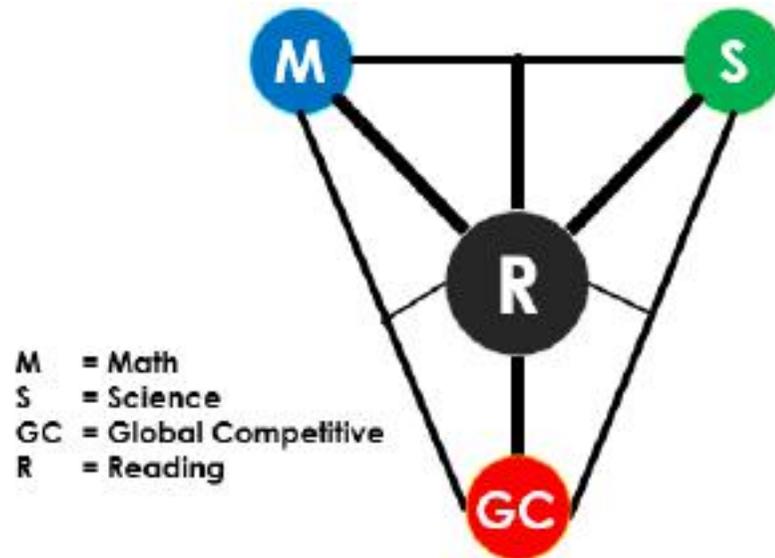
PISA 2021 DAN COMPUTATIONAL THINKING (CT)

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PISA

PISA (*Programme for International Student Assessment*) adalah studi internasional tentang prestasi literasi **membaca**, **matematika**, dan **sains** siswa sekolah berusia **15 tahun**



PISA merupakan sebuah Tes Internasional untuk melihat kemampuan Matematika, Ilmu Pengetahuan Alam (Science), Membaca (Reading), dan Kemampuan Global (Global Competitiveness)

Penyelenggaraan PISA



PISA merupakan studi yang diselenggarakan setiap tiga tahun sekali, yaitu pada tahun 2000, 2003, 2006, 2009, 2012, 2015, 2018, dan seterusnya. Indonesia mulai sepenuhnya berpartisipasi sejak tahun 2001.

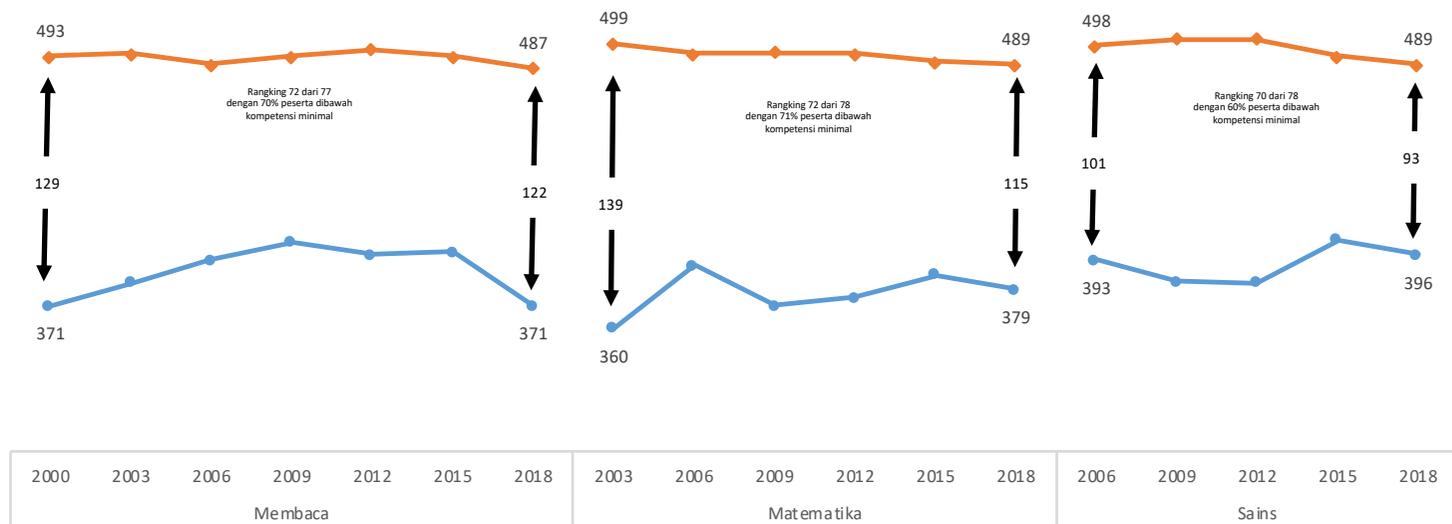


Penyelenggara studi adalah **OECD** (*Organisation for Economic Cooperation and Development*) beserta konsorsium internasional yang membidangi masalah Sampling, Instrumen, Data, Pelaporan, dan sekretariat

PISA tidak hanya memberikan informasi tentang benchmark Internasional tetapi juga informasi mengenai kelemahan serta kekuatan siswa beserta faktor-faktor yang mempengaruhinya



Tren Nilai dan Peringkat PISA Indonesia



Sumber: [OECD](https://www.oecd.org/pisa/), 2019

Ide sentral PISA untuk bidang matematika adalah tentang kemampuan **literasi matematika**



Literasi Matematika



Mathematical literacy is an individual's capacity to formulate, employ, and interpret mathematics in a variety of contexts. It includes reasoning mathematically and using mathematical concepts, procedures, facts and tools to describe, explain and predict phenomena. It assists individuals to recognise the role that mathematics plays in the world and to make the well-founded judgments and decisions needed by constructive, engaged and reflective citizens (OECD, 2013, p. 25).



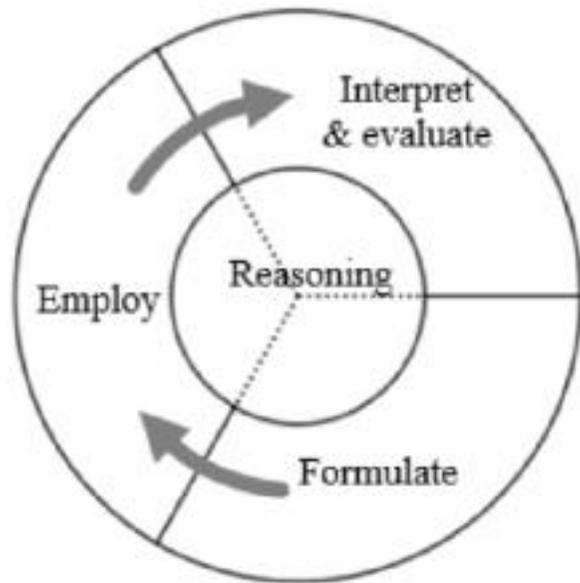
Mathematical literacy is an individual's capacity to reason mathematically and to formulate, employ, and interpret mathematics to solve problems in a variety of real-world contexts. It includes concepts, procedures, facts and tools to describe, explain and predict phenomena. It assists individuals to know the role that mathematics plays in the world and to make the well-founded judgments and decisions needed by constructive, engaged and reflective 21st century citizens (OECD, 2018, p. 7).



OECD mempertahankan definisi literasi matematika PISA 2012 pada PISA tahun 2015 dan 2018. Namun di tahun 2021 kemampuan literasi matematika didefinisikan ulang oleh OECD. Kerangka kerja PISA 2021 melihat bahwa literasi matematika yang awalnya fokus pada kemampuan perhitungan dasar harus didefinisikan ulang dengan memperhatikan kemajuan teknologi yang sangat cepat

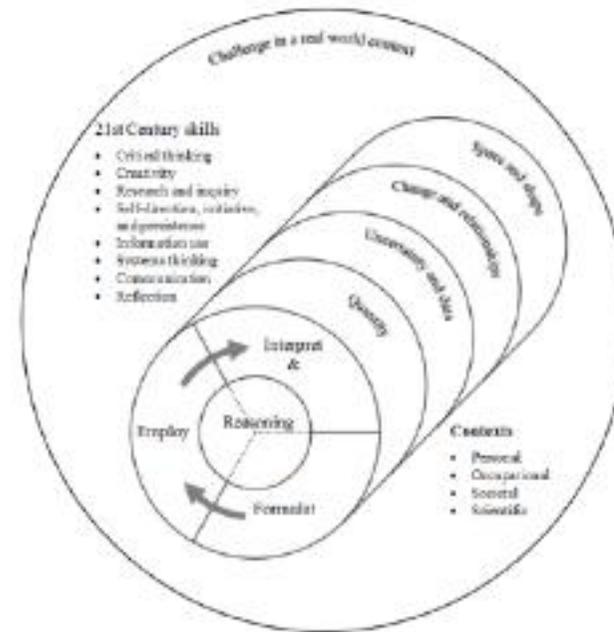


PISA 2012



Hubungan antara penalaran matematika dan siklus pemecahan masalah (pemodelan matematis)

PISA 2021



Hubungan antara penalaran matematika, siklus pemecahan masalah (pemodelan matematika), konten matematika, konteks dan keterampilan abad ke-21

Dalam *framework* PISA 2021, literasi matematika disebut haruslah mencakup hubungan sinergis dan timbal balik antara ***mathematical thinking*** (berpikir matematis) dan ***computational thinking*** (berpikir komputasional).



- *Computational thinking* didefinisikan sebagai kemampuan yang memayungi abstraksi, pemikiran algoritmik, otomasi, dekomposisi, dan generalisasi, yang kesemuanya dianggap penting dalam proses penalaran matematis dan penyelesaian masalah.
- *Computational thinking* dalam matematika dikonseptualisasikan sebagai kemampuan mendefinisikan dan menguraikan pengetahuan matematika yang dapat diekspresikan oleh pemrograman, yang memungkinkan siswa untuk memodelkan konsep dan hubungan matematika secara dinamis

Taksonomi *computational thinking* dalam PISA 2021

- Praktik data
 - Praktik pemodelan dan simulasi,
 - Praktik penyelesaian masalah komputasi, dan
 - Praktik pemikiran sistem
- 

Aspek-aspek organisasi domain PISA yang terkait dengan *computational thinking*

- Abstraksi dan representasi simbolis
- Pemodelan matematika
- Pemecahan masalah
- Penafsiran, aplikasi, dan
- Evaluasi luaran matematis

Dalam hal konten matematika, *computational thinking* disebut dalam pembahasan seluruh subkonten matematika

- Quantity
 - Uncertainty and data
 - Change and relationships
 - Space and shape
- 

Pembelajaran Computational Thinking di Indonesia

 Mengintegrasikan thinking skill pada pelajaran-pelajaran yang sudah ada

 Menyediakan kelas dan aktivitas tertentu yang memang khusus membahas *computational thinking* (Informatika)

-
- Di kalangan peneliti di bidang *computational thinking* dikenal istilah *Computer Science Unplugged Activities*, sebuah istilah untuk menyebut aktifitas-aktifitas pembelajaran prinsip-prinsip ilmu komputer yang tidak membutuhkan penggunaan computer
 - Beberapa riset terbaru menunjukkan bahwa *computational thinking* bahkan dapat diintegrasikan dalam mata pelajaran-mata pelajaran yang ada . Misalnya, prinsip *Unified Modeling Language (UML)*, yang dipelajari dalam bidang software engineering, ternyata dapat diintegrasikan dalam pembelajaran bahasa di tingkat sekolah dasar (di Austria)
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Contoh Soal Matematika dalam *Framework PISA 2021*



Smartphone Use

Soal ini menggambarkan kemampuan penilaian matematika berbasis komputer khususnya penggunaan spreadsheet dengan *sorting* dan kemampuan lainnya.

PISA 2021

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	200.863	23.226	
Philippines	105.341	28.627	
Thailand	68.416	30.486	
Turkey	81.086	44.771	
Vietnam	96.357	29.043	

PISA 2021

Smartphone use

Question 28

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

Which operation (columns B and C will determine the correct value in Column D)?

Explain your answer:

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

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)	Proportion of smartphone users
Bangladesh	160.136	8.621	
Indonesia	260.387	87.83	
Japan	126.738	65.282	
Malaysia	31.371	22.88	
Philippines	105.341	26.927	
Thailand	68.435	30.686	
Turkey	81.286	48.771	
Vietnam	96.287	29.943	

PISA 2021

Smartphone use

Question 29

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.	<input type="radio"/>	<input type="radio"/>
The country with the lowest number of smartphone users also has the smallest population.	<input type="radio"/>	<input type="radio"/>
The country with the highest proportion of smartphone users also has the smallest population.	<input type="radio"/>	<input type="radio"/>
The country with the median proportion of smartphone users is also the country with the median number of smartphone users.	<input type="radio"/>	<input type="radio"/>

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	160.136	8.621	5%
Indonesia	260.387	87.83	34%
Japan	126.738	65.282	52%
Malaysia	31.371	22.88	73%
Philippines	105.341	26.927	27%
Thailand	68.435	30.686	45%
Turkey	81.286	48.771	60%
Vietnam	96.287	29.943	31%

PISA 2021

Smartphone use

Question 30

You can change the horizontal axis variable between the **Population (in millions)** and the **Minimum hourly wage (in Zedis)** 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 (Zedis)

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 Zedis)** for each country.

Population | Hourly wage

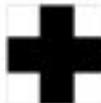
Tiling

Soal ini menggambarkan penalaran dan computational thinking dan representasi geometris.

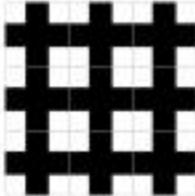
PISA 2021

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.

PISA 2021

Tiling
Question 20

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 floor continues to tile the floor by extending the pattern in the same way.

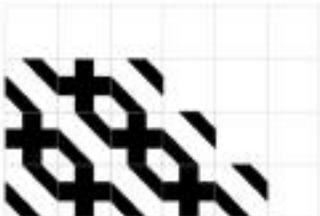
Study the pattern.

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



PISA 2021

Tiling
Question 20

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

The floor 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.

TILING INSTRUCTIONS

For row = 1 to 6

"Find the next tile to be placed in the row"

IF the row is an odd-numbered row

THEN use tile A in

ELSE use tile B in

"Complete the row by adding tiles"

IF the previous tile is

use

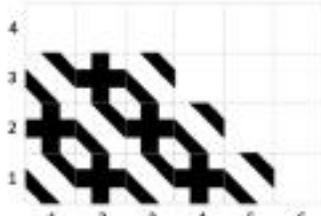
use

Next row

TILING




Tile A Tile B



PISA 2021

Tiling
Question 20

Refer to "Tiling" on the right. Click on the choice to answer the question.

The floor 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).

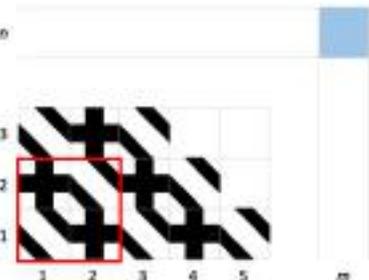
Study the tiling pattern and in particular the four tiles highlighted with a red border. Select ALL of the rules below that will correctly predict the tile that is needed for any grid position (m, n).

Rule	
If m + n is odd use tile A, otherwise use tile B	<input type="radio"/>
If m + n is even use tile A, otherwise use tile B	<input type="radio"/>
If m is odd use tile A, otherwise use tile B	<input type="radio"/>
If m is even use tile A, otherwise use tile B	<input type="radio"/>
If m is odd and n is odd use tile A, otherwise use tile B	<input type="radio"/>
If m and n are both odd or both even use tile A, otherwise use tile B	<input type="radio"/>

TILING




Tile A Tile B



PISA 2021

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

Study the grid below to see what the tiling pattern that will be the next one.

TILING

Tile A

Tile B

PISA 2021

Item
Question 4/5

The tiling pattern on the right is created using a combination of two tiles, B and C. Jesse continues to build 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

PISA 2021

Item
Question 4/5

The tiling pattern on the right is a portion 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 tables below describe 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	D A C	B C A	<input type="radio"/>
B C A	C A B	A C B	<input type="radio"/>
A B C	B C A	B A C	<input type="radio"/>
A B C	B C A	C A B	<input type="radio"/>

TILING

Tile A

Tile B

Tile C

Navigation

Soal ini menggambarkan penalaran dalam konteks geometris dan kemampuan penilaian matematika) berbasis komputer

PISA 2021

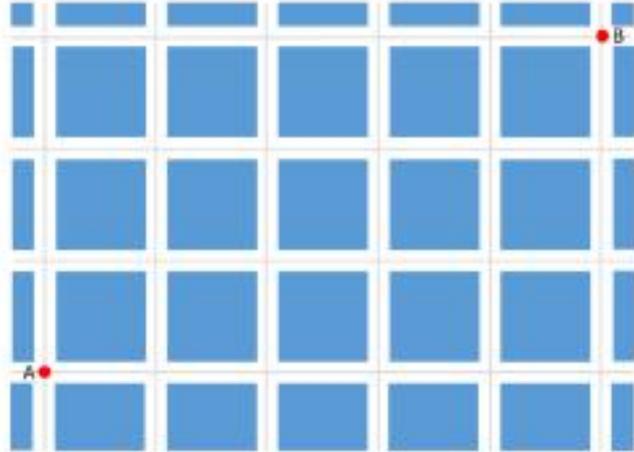
Navigation
Introduction

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.



PISA 2021

Navigation
Introduction continued
Clear the introduction and select the different route to see the different routes. This route is the BEST answer.

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

- Ann always moves right or up and stays below her so-called 'staircase' 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).
- Cory always moves right or up and stays above her so-called 'staircase' to the straight red line joining A and B (purple line).

PISA 2021

Navigation
Introduction continued
Clear the introduction and select the different route to see the different routes. This route is the BEST answer.

NAVIGATION
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PISA 2021

Navigation
Introduction continued
Clear the introduction and select the different route to see the different routes. This route is the BEST answer.

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- Cory always moves right or up and stays above her so-called 'staircase' to the straight red line joining A and B (purple line).

PISA 2021

Navigation
Question 14
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 respective 'staircase' paths for Ann, Bob and Cory are all the same length for each position of 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	Cory's route
1			
2			
3			
4			

PISA 2021

Navigation
Question 14
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 D will be 7 units long.

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

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

True
 False

Provide a reason for your answer.
- There exists a route from C to D that includes Diagonal 2 and is shorter than 7 units.

True
 False

Provide a reason for your answer.
- There exists a route from C to D 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.

TERIMA KASIH

