# ML Math-percentage-percentile

# Percentage and Percentile

**What is a Percentage?**

A percentage is just a number out of 100.

If you scored 90% on a test, it means

- you got 90 out of 100 marks or
- 9 out of 10 or
- 18 out of 20
- 180 out of 200 and so on.

**What is percentile ?**

A percentile is a value below which a certain percentage of data falls. It shows the **relative standing of a value within a dataset**.

If you are in the 90th percentile of a test, it means

- you scored better than 90% of the people who took it  or
- you can say that 90% of students are below your score.

**Example1:** Let's say 10 students took a test and got the following scores out of 200.

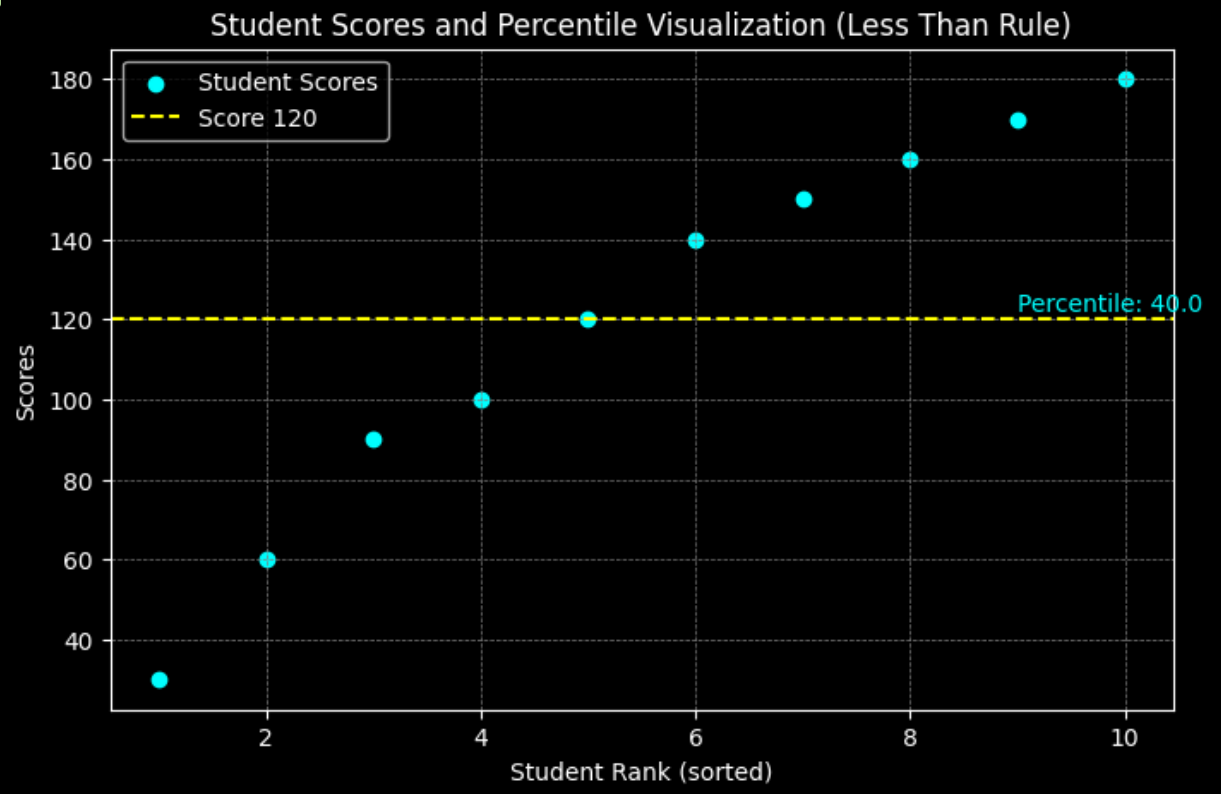
[90, 60, 180, 170, **120**, 140, 150, 160, 100, 30].

Calculate the percentage and percentile of student who scored 120.

**ANSWER:**

**Percentage:** The test is out of 200, and the student scored 120

So, his percentage would be $\frac{120}{200} * 100$ **= 60%**




**Percentile:**

Step1) First arrange in ascending order.

[30, 60, 90, 100, **120**, 140, 150, 160, 170, 180]

Step2) Count how many scores are less than 120 and convert that into percentage.

Scores below 120 = [30, 60, 90, 100] → 4 students

Percentage of students who scored below 120

**=** $\frac{4}{10} * 100$ **= 40**

So, his percentile is 40$^{th}$ percentile. **Even if the student's percentage is 60%, his percentile (i.e. 40) depends on how others performed** — in this case, better-performing students pushed the percentile down.

**Example2:** Let's say 10 students took a test and got the following scores out of 200:

[30, 60, 180, 170, 120, 140, 150, 160, 100, 90].

Calculate the 30th percentile

**ANSWER:**

1) First arrange in ascending order:

[30, 60, 90, 100, 120, 140, 150, 160, 170, 180]

2) Calculate the rank (position):

The formula for the position (rank) is:

$$R = \frac{P}{100} \times (n+1)$$

where

- $P$ = desired percentile (30 here)
- $n$ = number of data points

$$R = \frac{30}{100} \times (10+1) = 0.3 \times 11 = 3.3$$

So, the **30th percentile lies at the 3.3rd position** in the ordered list.

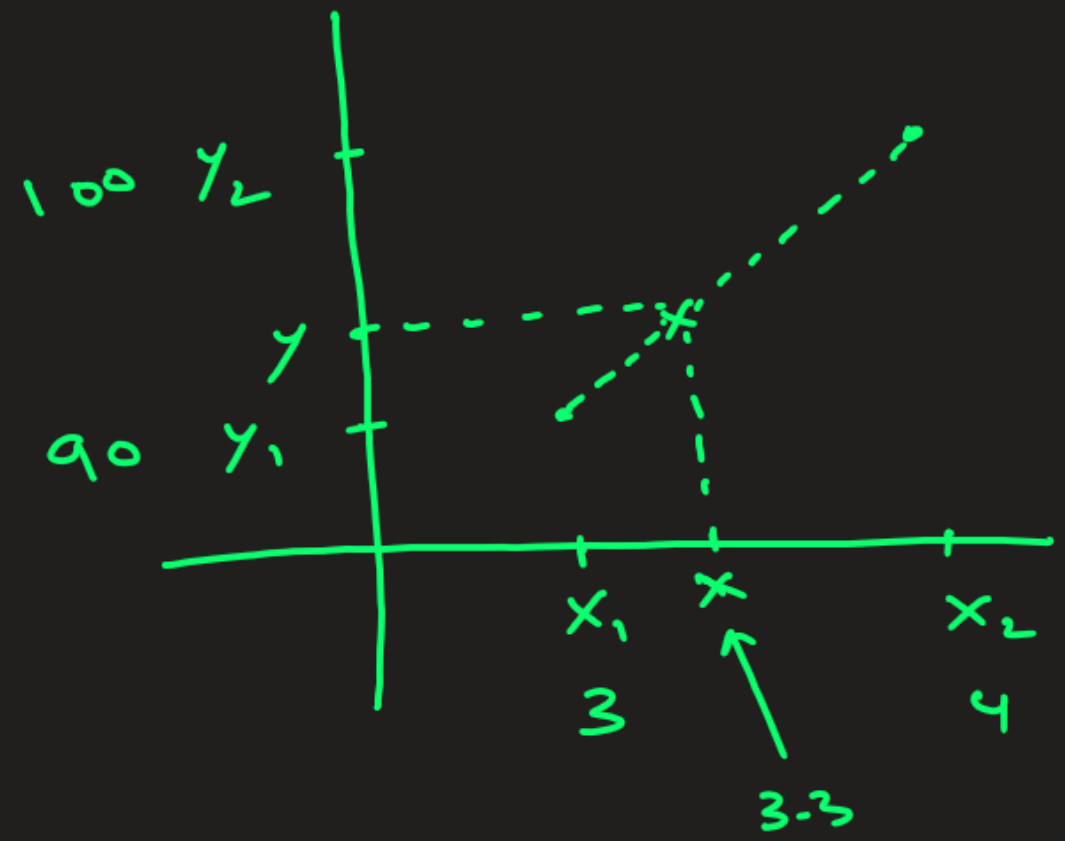
3) Interpolate if necessary:
The rank is **3.3**, which means the 30th percentile lies between the **3rd** and **4th** values in the sorted list:
3rd value = 90
4th value = 100

Now interpolate between these two (explained on next page):

30th percentile = 90 + 0.3 × (100 − 90)
= 90 + 3
= **93**

**Interpretation: 30% of students scored below 93.**

# Linear Interpolation Explained




$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$= \frac{100 - 90}{4 - 3}$$

$$= 10$$

$$y = y_1 + (x - x_1) \cdot m$$

$$= 90 + .3(10)$$

$$= 93$$

# STOP

# Practice: Percentile (p2)

**Example3:**

Let's say 10 students took a test and got the following scores out of 200:

[45, 50, 65, 70, 75, 185, **80**, 55, 60, 190].

a) Compute percentage and percentile of student who scored 80.

ANSWER: a) Arrange the numbers in ascending:

[45, 50, 55, 60, 65, 70, 75, **80**, 185, 190].

Percentage of students who scored 80 = (80/200) * 100 = **40%**

Percentile of this student who scored 80 = There are 7 students out of 10 whose scores are below 80:

So percentile of this student is (7/10) * 100 → **70th percentile**

# ML Math-PERCENTAGE-percentile

# What is Statistics?

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