# Yubercept

Students explore the-intercept through the context of ride-share costs. They look at the effect of the -intercept on the graph and equation and establish the meaning in different contexts.

## Visible learning

### Learning intention

* To know how the -intercept affects the equation and graph of a line.

### Success criteria

* I can identify the -intercept of a graph.
* I can identify the -intercept in an equation.
* I can explain how the -intercept affects the graph of a linear relationship.
* I can explain what the -intercept represents in different contexts.

### Syllabus outcomes

* develops understanding and fluency in mathematics through exploring and connecting mathematical concepts, choosing and applying mathematical techniques to solve problems, and communicating their thinking and reasoning coherently and clearly **MAO-WM-01**
* **determines the midpoint, gradient and length of an interval, and graphs linear relationships, with and without digital tools MA5-LIN-C-01**
* **graphs and interprets linear relationships using the gradient/slope-intercept form   
  MA5-LIN-C-02**

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## Activity structure

Please use the associated PowerPoint *Yubercept* to display images in this lesson.

### Launch

1. Read the scenario below to students, writing the numerical information on the board.

Person 1 and Person 2 are travelling into town to a concert. They are both using Yuber to get to the venue.

Person 1 lives 10 km from the venue and will be charged $17.50.

Person 2 lives 20 km from the venue and will be charged $32.

1. In a Think-Pair-Share ([bit.ly/thinkpairsharestrategy](https://bit.ly/thinkpairsharestrategy)), ask students to notice and wonder ([bit.ly/noticewonderstrategy](https://bit.ly/noticewonderstrategy)) about the difference between the costs and distances travelled when using Yuber.

Prompt students to think about the following questions to continue their discussion:

* Predict how much it would cost if they lived 30 km from the venue.
* When the distance is doubled, why hasn’t the rate doubled?

The purpose of this activity is for students to consider if there is a cost before they start to travel.

1. Display slide 2 from the PowerPoint *Yubercept,* which shows the graph and equation from the launch scenario. In a Think-Pair-Share, ask students to discuss the self-explanation prompts:
2. How does this graph differ to the ones we have looked at in previous lessons?
3. What is the gradient of this graph and what does it represent?
4. What does the point (0, 3) represent?

Students should notice that this graph doesn’t go through the origin. Students may be able to identify that most rideshare services have a call-out fee before you start to travel anywhere. The gradient of the graph would represent the cost of travel per kilometre.

### Explore

1. Assign students the Desmos classroom activity ‘Flags’ (<https://bit.ly/Desmos_Flags>). Alternatively, teachers can use slides 3 to 6 of the PowerPoint *Yubercept* to introduce these concepts.

These instructions will help teachers set up a Desmos classroom and assign this activity to a class ([bit.ly/desmosclassroomstrategy](https://bit.ly/desmosclassroomstrategy)).

1. Students are to work through each screen individually or in pairs.

This activity introduces students to the y-intercept in terms of the starting height of a flag. The gradient represents the speed at which the flag rises to its final height. Students are introduced to equations of the form in which the is the starting height of the flag.

### Summarise

1. Use a Pose-Pause-Pounce-Bounce questioning technique [PDF 200 KB] ([bit.ly/pausepouncebounce](https://bit.ly/pausepouncebounce)) to allow students to share what they learned during the Explore activity.
2. Introduce students to the terminology ‘y-intercept’ and explain that this is the point where the line crosses the -axis or the -value when .
3. Students are to make notes to their future forgetful self ([bit.ly/notesstrategy](https://bit.ly/notesstrategy)) on how to find the value of the -intercept in an equation or graph and how the value of the-intercept affects the graph.
4. Students are to complete the Spider diagram ([bit.ly/linearspider](https://bit.ly/linearspider)) which uses variation theory ([variationtheory.com/introduction/](https://variationtheory.com/introduction/)) to highlight changes.

This activity includes equations that are not in the form . These have been included to challenge students but can be omitted or modified to suit the readiness of students.

1. Use slide 7 from the PowerPoint *Yubercept*, to display the equation . Using a Think-Pair-Share, ask students to discuss how they might find the y-intercept of this equation.

### Apply

#### Dicey lines

1. In pairs, or groups of 3, give students 2 dice each and Appendix A ‘Dicey lines’.
2. Students are to complete the table in Appendix A ‘Dicey lines’ by rolling each dice. The number on the first dice gives the gradient and the number on the second dice gives the y-intercept. Students are to write an equation using the 2 numbers from the dice.
3. The student with the largest -value when , earns a point. Play continues for 10 rounds.

#### Jigsaw activity

1. Set up a Jigsaw task ([bit.ly/jigsawgroupstrategy](https://bit.ly/jigsawgroupstrategy)) with 3 stations, each having a different scenario found in Appendix B ‘Scenarios’.
2. In their visibly random groups of 3, students are to go to one station each. Students are to complete Appendix C ‘Question set’, where they explain the meaning of the value of the gradient and y-intercept in each context.

Simplistic linear models are used throughout this activity. Teachers could conduct a class discussion to consider whether these scenarios would actually follow a linear relationship in real life.

1. Students are to return to their groups and explain their scenario and what they came up with for the others to give peer feedback using the TAG feedback strategy ([bit.ly/TAGstrategy](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/549)).

## Assessment and differentiation

### Suggested opportunities for differentiation

**Launch**

* This activity is a notice and wonder with no correct answers, so all students should be challenged to contribute.
* Students could share their own experiences with using rideshare companies.

**Explore**

* If using the Desmos activity, students should be encouraged to experiment and test their theories.
* For students who are not as confident, skip the activity on slide 7of the PowerPoint *Yubercept* where students are asked how they might find the-intercept in an equation not in gradient intercept form.

**Summarise**

* Modify the Spider diagram so that all the equations are in gradient-intercept form.
* Give students access to Desmos to graph the equations in the Spider diagram to help them identify the gradient and -intercept visually.

**Apply**

* Students can be asked to decide which dice to use as the gradient or y-intercept to better their chances of winning.
* Students can be given more dice to explore the game with fractional gradients and -intercepts.

### Suggested opportunities for assessment

**Explore**

* The Desmos teacher dashboard can be monitored to identify student misconceptions.

**Summarise**

* Students’ ability to identify the differences in the Spider will help identify any misconceptions students have about where the -intercept is within the equation.

**Apply**

* When playing the ‘Dicey lines’ game, students give peer feedback to tell whether their opponent has written the correct equation.

## Appendix A

### Dicey lines

1. Roll both dice to establish the values of the gradient and y-intercept. The value of the first dice will be the gradient and the value of the second dice will be the -intercept.
2. Complete the table below by writing the equation of a line using the gradient and -intercept from the dice values.
3. Find the value of your equation when .

The winner of each round is the player whose value at is the largest.

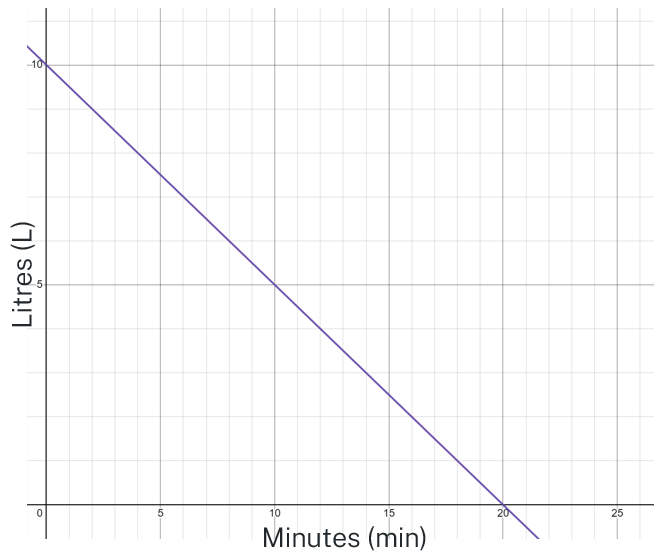
|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Round | Gradient | y-intercept | Equation |  | Win |
| 1 |  |  |  |  |  |
| 2 |  |  |  |  |  |
| 3 |  |  |  |  |  |
| 4 |  |  |  |  |  |
| 5 |  |  |  |  |  |

## Appendix B

### Scenarios

#### Hole in my bucket

Liza accidentally put a hole in her bucket. Over time, it emptied. The volume in the bucket can be displayed by the graph below.



#### Climbing to Everest base camp

A group of hikers climb from the base camp of Everest every day. Each day they travel they get higher in altitude. This can be represented by the equation:

Where is the days travelled and is their altitude.

#### Height of a candle

Yumi bought a candle that had a burn life of 85 hours. The height of the candle over the first 4 hours is displayed in the table of values below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Hours burning | 0 | 1 | 2 | 3 |
| Height | 15 |  |  |  |

## Appendix C

### Question set

Send one person from your group of 3 to each station to answer the following questions.

1. What is your scenario?
2. What is the value of the y-intercept in your scenario?
3. What does the -intercept represent in your scenario?
4. What is the value of the gradient in your scenario?
5. What does the gradient represent in your scenario?

Once completed, return to your group and explain your scenario and your solutions and how you established your answers.

## Sample solutions

### Appendix A – dicey lines

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Round | Gradient | y-intercept | Equation |  | Win |
| 1 | 2 | 1 |  | 11 |  |
| 2 | 5 | 6 |  | 31 |  |
| 3 | 3 | 2 |  | 17 |  |
| 4 | 5 | 5 |  | 30 |  |
| 5 | 2 | 3 |  | 13 |  |

### Appendix B – scenarios

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Scenario | y-intercept | Meaning in context | Gradient | Meaning in context |
| Hole in a bucket | 10 | The bucket initially held 10 L |  | The hole in the bucket emptied  L per minute |
| Climbing to Everest base camp | 1400 | Was the altitude at the base of the mountain | 424.3 | They climbed 424.3 m per day |
| Height of a candle | 15 | The candle was originally 15 cm |  | The candle burned  cm per hour |

## References

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