



Mathematics 1A

ITMTA1-44



Eduvos
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Week 0: Lesson 1

Induction and Orientation Functions and Models

- Interpret a function from an algebraic, numerical, graphical and verbal perspective and extract information relevant to the phenomenon modelled by the function.
- Find the domain and the range of a function.
- Identify the graph of a function by performing the vertical line test.
- Identify symmetries of graphs and the relations they represent.
- Identify and sketch the different types of functions (linear, quadratic, power, root, polynomial, rational, algebraic, exponential, logarithmic and piecewise functions) and their properties.

Week 0

Lesson 1

What will be covered in today's lesson?

Interpret a function



Determine the domain and range



Identify functions



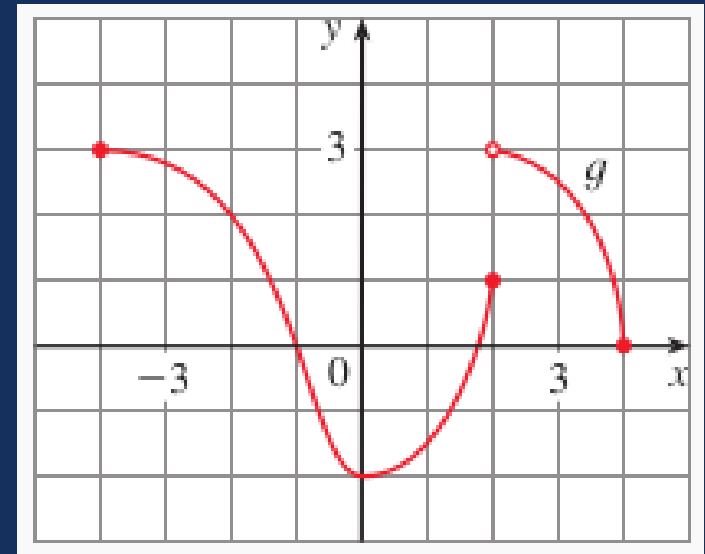
Identify symmetries



Identify & sketch functions

Case Study

The graph of a function g is given.



- State the values of $g(-2)$, $g(0)$, $g(2)$ and $g(3)$.
- For what value(s) of x is $g(x) = 3$?
- For what value(s) of x is $g(x) \leq 3$?
- State the domain and range of g .
- On what interval(s) is g increasing?

Source: Stewart, J. 2016. Calculus: Metric Version, Early Transcendentals. 9th edition. USA: Cengage.

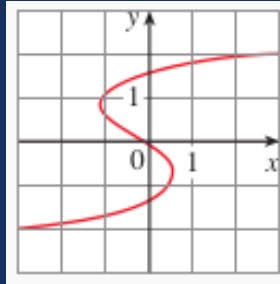


Case Study

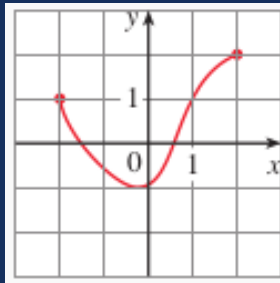


Determine whether the curve is the graph of a function of x . If it is, state the domain and range of the function.

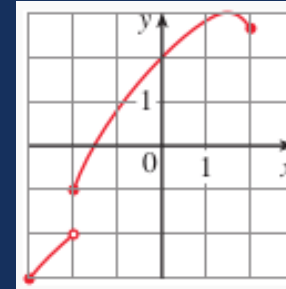
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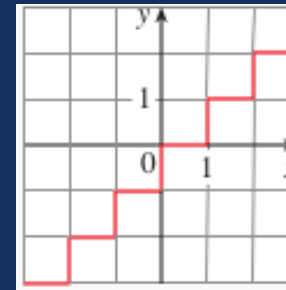
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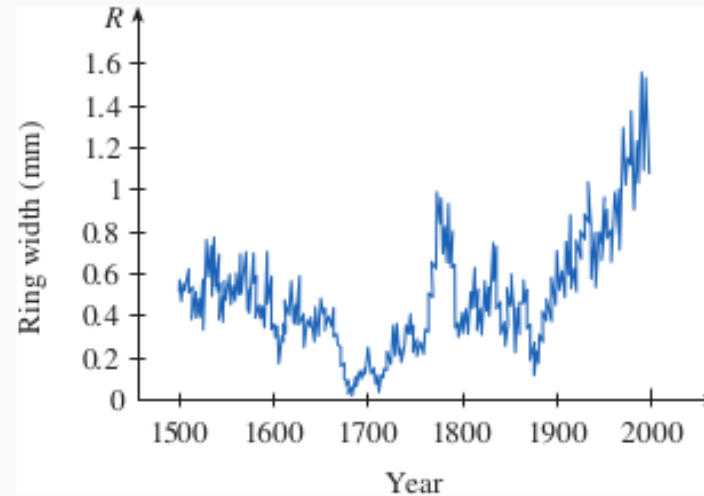
4.



Source: Stewart, J. 2016. Calculus: Metric Version, Early Transcendentals. 9th edition. USA: Cengage.

Case Study

Trees grow faster and form wider rings in warm years and grow more slowly and form narrower rings in cooler years. The figure shows ring widths of a Siberian pine from 1500 to 2000.



Source: Adapted from G. Jacoby et al., "Mongolian Tree Rings and 20th-Century Warming," *Science* 273 (1996): 771–73.

- What is the range of the ring width function?
- What does the graph tend to say about the temperature of the earth? Does the graph reflect the volcanic eruptions of the mid-19th century?

Source: Stewart, J. 2016. *Calculus: Metric Version, Early Transcendentals*. 9th edition. USA: Cengage.

Case Study

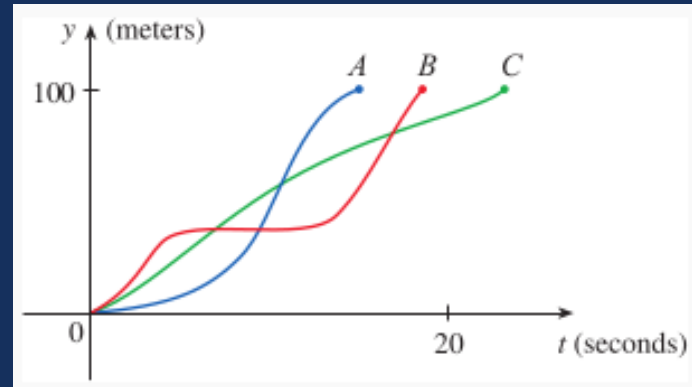
You place a frozen pie in an oven and bake it for an hour. Then you take it out and let it cool. Describe how the temperature of the pie changes as time passes. Then sketch a rough graph of the temperature of the pie as a function of time.

Source: Stewart, J. 2016. Calculus: Metric Version, Early Transcendentals. 9th edition. USA: Cengage.



Case Study

Three runners compete in a 100-meter race. The graph depicts the distance run as a function of time for each runner. Describe in words what the graph tells you about this race. Who won the race? Did each runner finish the race?



Source: Stewart, J. 2016. Calculus: Metric Version, Early Transcendentals. 9th edition. USA: Cengage.

Case Study

Temperature readings T (in $^{\circ}\text{C}$) were recorded every two hours from midnight to 2:00 pm in Atlanta on a day in June. The time was measured in hours from midnight.

t	0	2	4	6	8	10	12	14
T	23	21	20	19	21	26	28	30

- Use the readings to sketch a rough graph of T as a function of t .
- Use your graph to estimate the temperature at 9:00 am.

Source: Stewart, J. 2016. Calculus: Metric Version, Early Transcendentals. 9th edition. USA: Cengage.



Activity

Evaluate the difference quotient for the given function. Simplify your answer.

$$1. \ f(x) = \frac{1}{x}, \quad \frac{f(x) - f(a)}{x - a}$$

$$2. \ f(x) = \frac{x^2 + 1}{x^2 + 4x - 21}$$

$$3. \ f(u) = \frac{u + 1}{1 + \frac{1}{u + 1}}$$

$$4. \ F(p) = \sqrt{2 - \sqrt{p}}$$

Activity

1. Find the domain and sketch the graph of the function.

$$f(x) = \frac{x^2 - 4}{x - 2}$$

2. Evaluate $f(-3)$, $f(0)$ and $f(2)$ for the piecewise defined function. Then sketch the graph of the function.

$$f(x) = \begin{cases} -1 & \text{if } x \leq 1 \\ 7 - 2x & \text{if } x > 1 \end{cases}$$

Activity

Determine whether f is even, odd, or neither. You may wish to use a graphing calculator or computer to check your answer visually.

1. $f(x) = \frac{x}{x^2 + 1}$

2. $f(x) = \frac{x^2}{x^4 + 1}$

3. $f(x) = x|x|$

Activity

Classify each function as a power function, root function, polynomial (state its degree), rational function, algebraic function, trigonometric function, exponential function, or logarithmic function.

1. $f(t) = \frac{3t^2 + 2}{t}$

2. $h(r) = 2.3^r$

3. $s(t) = \sqrt{t + 4}$

4. $y = x^4 + 5$

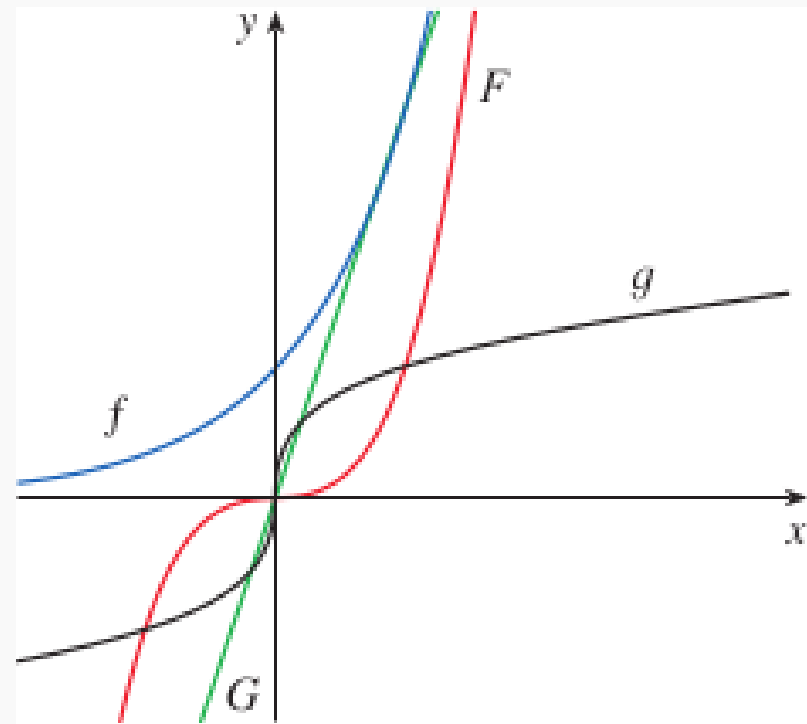
5. $g(x) = \sqrt[3]{x}$

6. $y = \frac{1}{x^2}$

Activity

Match each equation with its graph. Explain your choices. (Don't use a computer or graphing calculator.)

1. $y = 3x$
2. $y = 3^x$
3. $y = x^3$
4. $y = \sqrt[3]{x}$



Source: Stewart, J. 2016. Calculus: Metric Version, Early Transcendentals. 9th edition. USA: Cengage.

Case Study



The monthly cost of driving a car depends on the number of kilometers driven. Lynn found that in May it cost her \$380 to drive 770 km and in June it cost her \$400 to drive 1290 km.

1. Express the monthly cost C as a function of the distance driven d , assuming that a linear relationship gives a suitable model.
2. Use part (a) to predict the cost of driving 2400 km per month.
3. Draw the graph of the linear function. What does the slope represent?
4. What does the C -intercept represent?
5. Why does a linear function give a suitable model in this situation?

Source: Stewart, J. 2016. Calculus: Metric Version, Early Transcendentals. 9th edition. USA: Cengage.

What Happens Next?

- Chapter 1 – Section 1.3 – 1.4