

## 7.3 Investigate Exponential Relationships

### A Compare relations by their Formula

- ✓ A linear relation has a formula of the form:  $y = ax + b$
- ✓ A quadratic relation has a formula of the form:
  - $y = ax^2 + bx + c$  or
  - $y = a(x - h)^2 + k$  or
  - $y = a(x - r)(x - s)$
- ✓ An exponential relation has a formula of the form:  $y = b^x$

Note that the variable  $x$  is part of the exponent for an exponential relation.

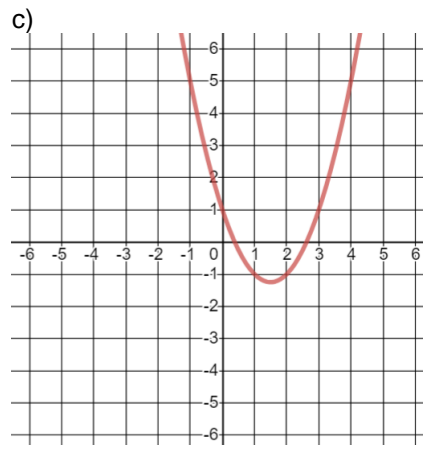
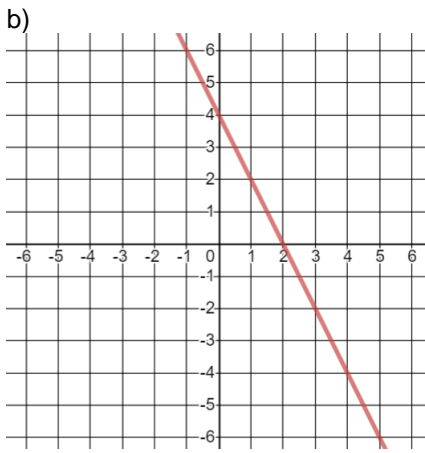
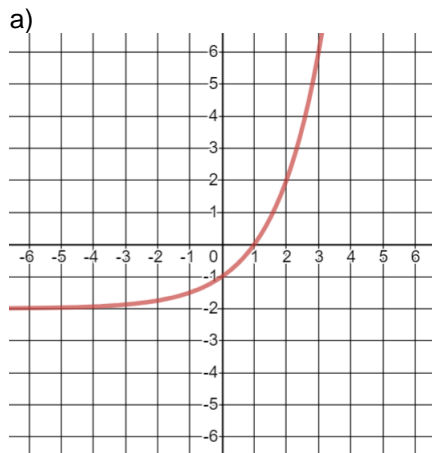
Example 1. Classify each of the following relations as linear, quadratic or exponential.

- a)  $y = x^2 - x + 1$       b)  $y = -2x + 3$       c)  $y = 2^x$       d)  $y = (x - 1)(x + 2)$       e)  $y = 10^x$

### B Compare relations by their Graphs

- ✓ The graph of a linear relation is a line.
- ✓ The graph of a quadratic relation is a parabola.
- ✓ The graph of an exponential relation is very steep at one end and almost horizontal at the other end.

Example 2. Classify each of the following relations as linear, quadratic or exponential.



**C Compare relations by their Tables of Values**

- ✓ The first order differences are constant for a linear relation.
- ✓ The second order differences are constant for a quadratic relation.
- ✓ The ratios of the first order differences are constant for an exponential relation.

Example 3. Classify each of the following relations as linear, quadratic or exponential.

a)

x	y			
-2	5			
-1	2			
0	1			
1	2			
2	5			

b)

x	y			
-2	-5			
-1	-4			
0	-3			
1	-2			
2	-1			

c)

x	y			
-2	0.25			
-1	0.5			
0	1			
1	2			
2	4			

**D Compare relations from Real Life**

Example 4. The value of a car is now (Jan 2021) \$10,000. Its value depreciates by 5% each year. Make a table of value showing the values of the car for the next 5 year. Classify this relation as linear, quadratic, or exponential.

Year	Value	First Differences	Ratios
Jan 2021	\$10,000		
Jan 2022			
Jan 2023			
Jan 2024			
Jan 2025			

Conclusion:

Example 5. The value of a house is now (Jan 2021) \$100,000. Its value appreciates by \$5,000 each year. Make a table of value showing the values of the house for the next 5 year. Classify this relation as linear, quadratic, or exponential.

Year	Value	First Differences	Ratios
Jan 2021	\$100,000		
Jan 2022			
Jan 2023			
Jan 2024			
Jan 2025			

Conclusion:

Example 6. The population of a bacteria is today (day 1) at 1,000 and its population doubles every three days. Make a table of value showing the values of the population for the next two weeks. Classify this relation as linear, quadratic, or exponential.

Day	Population	First Differences	Ratios
Day 1	1,000		
Day 4			
Day 7			
Day 10			
Day 13			
Day 15			

Conclusion:

Example 7. Julia was born in Jan 1, 2010. Her parents considered education very important for her daughter and decided to open a bank account specially designed for her future education. On the first Julia's anniversary, they deposited  $1 \times \$100$  into this account. On the second anniversary, they deposited  $2 \times \$100$ . On the third anniversary, they deposited  $3 \times \$100$ , and so on. Make a table of value showing the total amount of money accumulated for the first 5 anniversaries. Classify this relation as linear, quadratic, or exponential.

Anniversary	Total amount of money	First Differences	Second Differences	Ratio
1				
2				
3				
4				
5				

Conclusion:

Example 8. A ball bouncing on the floor reaches  $\frac{3}{4}$  of its previous maximum height. The initial height is 64 m. Make a table of value showing the values of the height for the next 5 bounces. Classify this relation as linear, quadratic, or exponential.

# of bounces	Height	First Differences	Ratios
0	64 m		
1			
2			
3			
4			
5			

Conclusion:

Notes: Textbook Pages 372-376

Homework: Textbook Pages 377 # 1, 2, 3, 7, 9