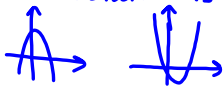


Quadratic Models

All mathematical models can be represented using **table of values, graphs and equations.**

What are the identifying features of a quadratic model?
 Table: **The second differences are constant.**

Graph: **The graph of a quadratic relation is called a parabola.**



Equation:

Standard form $\leftrightarrow y = ax^2 + bx + c$, *a, b and c are real numbers and $a \neq 0$*

Vertex form $\rightarrow y = a(x-h)^2 + k$
 vertex: (h, k)

Factored form $\rightarrow y = a(x-t)(x-s)$
 $x=t$ & $x=s$ are the x -intercepts

Given a set of data a quadratic regression can be performed to determine if the best model for the data is quadratic.

Oct 31-10:33 PM

1. Which table of values models a quadratic relation? How do you know?

t	0	1	2	3	4
c	0.5	2	8	32	128

t	0	1	2	3	4
c	0.5	5.5	20.5	45.5	80.5

a)

t	c	First Diff.	Second Diff.
0	0.5	$2-0.5=1.5$	$6-1.5=4.5$
1	2	$8-2=6$	$24-6=18$
2	8	$32-8=24$	$96-24=72$
3	32	$128-32=96$	
4	128		


∴ This table of values does not model a quadratic relation since the second diff. are not constant.

b)


t	c	First Diff.	Second Diff.
0	0.5	$5.5-0.5=5$	$15-5=10$
1	5.5	$20.5-5.5=15$	$25-15=10$
2	20.5	$45.5-20.5=25$	$35-25=10$
3	45.5		
4	80.5		

∴ This table of values rep. a quadratic relation since the second differences are the same/const.


2. Which graphs might model a quadratic relation? Why do you think so?



Quadratic (parabola)



Linear



Quadratic (half of the parabola)

3. Which equations model a quadratic relation? How do you know?


a) $y = -2x$ **Linear** ($y = mx + b$)

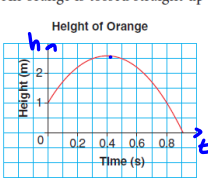
b) $y = x^2 + 1$ **Quadratic** ($y = ax^2 + bx + c$, $b = 0$)

c) $y = 5 - 2x$ **Linear** ($y = mx + b$)

Oct 31-10:37 PM

6. An orange is tossed straight up in the air.





a) When is the height of the orange increasing? When is it decreasing?
Increasing: $0 \leq t \leq 0.4$
Decreasing: $0.4 \leq t \leq 0.9$

b) When is the height of the orange changing rapidly? When is it changing slowly?
Increasing rapidly: $0 \leq t \leq 0.3$
Increasing slowly: $0.3 \leq t \leq 0.4$
Decreasing rapidly: $0.5 \leq t \leq 0.9$
Decreasing slowly: $0.4 \leq t \leq 0.5$

Oct 31-10:51 PM

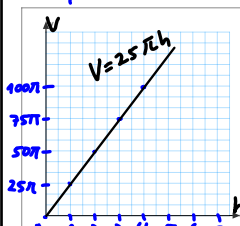
5. The formula for the volume of a cylinder with radius r and height h is:
 $V = \pi r^2 h$


a) Which variable(s) in the formula $V = \pi r^2 h$ should you set constant to generate a linear relationship? Explain why you made that choice.
Ans: Set $r = 5$ (or any constant).
 $V = \pi (5)^2 h$
 $V = 25\pi h$

b) Which variable(s) in the formula $V = \pi r^2 h$ should you set constant to generate a quadratic relationship? Explain why you made that choice.
Ans: Set $h = 5$.
 $V = \pi r^2 (5)$
 $V = 5\pi r^2$

c) Verify your answers to parts a) and b) by graphing $V = \pi r^2 h$ when $r = 5$ cm and when $h = 5$ cm. Were you correct? Explain.

r	V
0	0
1	5π
2	20π
3	45π





Homework: Pg. 304: #5,7,9,10,12,14

Oct 31-10:52 PM