A Standard Framework for Tablet Applications in Mathematics Education

Razieh Shahriari[1] , Ryan Thomas[1], Shannon Dingman[1]
Email: rshahria@uark.edu

1-University of Arkansas, Mathematics Department, Fayetteville, AR.

OUTLINE

- Theories of learning
- Technology in education
- Math educational apps
- Categories of math apps
- Many educational math apps

Behaviorism

Stimulus-response model of learning that emerged in early 20th century. Based on works of Ivan Pavlov, and Skinner

Definition: Learning is acquisition of new behavior

Role of learners

Passive , response to stimuli

Role of Teachers

Design the environment

Shape child behavior

Example: Negative and positive reinforcement, Sticker for young ages

Acquire diamond or coins in educational apps

Ref: Merleau-Ponty, M. (1963). The structure of behaviour.

Cognitive Constructivism

In contrast to behaviorism, cognitive constructivism theory states that learning is not change in behavior but it is an internal process.

Definition: Learning, is the process of adjusting mental models to accommodate new experiences

Role of learners: Creating association,

Process information to assimilate new information

Role of Teachers: Help student to connect new information to "Schema"

Example: Real world examples

Associate new concepts with something that is known

Wadsworth, B. J. (1996). Piaget's theory of cognitive and affective development: Foundations of constructivism . Longman Publishing.

Social Constructivism

Knowledge is constructed within the individual, but group interactions play an important role

Definition: People learn through their interaction with the world

Role of learners:
Construct the new concepts based on knowledge and social interaction.

Role of Teachers:
Making connection,

Promote discussion among students

Example: Discussion between students.

Technology in education

E-learning	The use of electronic technology in learning and teaching.
M-learning	(Mobile-Learning): refers to the use of mobile or wireless devices in learning and teaching
U-learning	(Ubiquitous learning): a new learning model that uses technology for learning from everywhere.

Educational apps

Numerous educational apps are available

Mostly apps are designed based on commercial purposes.

Educators and teachers should evaluate the effectiveness of apps

Educational math applications

Extensive mathematic apps available.
Categories help us to select effectively

Analytical apps

Simulators: Projectile Calculators
Guided discovery: Think 3D, Move the turtle
Calculators: FX Algebra

Productive apps

Measurement: Protractor
Drawing, graphing: Quick Graph
Composing: iMovies, SurveyBoys

Instructive apps

Reference: Math Dictionary
Drill and practice: Math Paradise
Tutorial: Wolfram Algebra

Handal B, et. al. A framework for categorising mobile applications in mathematics education. . 2013.

Educational applications

Categories based on theories of learning

Behaviorism apps

Feedback base: Algebra, Math8,
explanatory: Mathkit
Practice base: ACT Algebra
Tutorial: Khan Academy

Cognitive Constructivism apps

exploring apps: Move the turtle
Sequential learning apps: Math 8
Graphical apps: Desmos,
Virtual Math Lab: GeoGebra

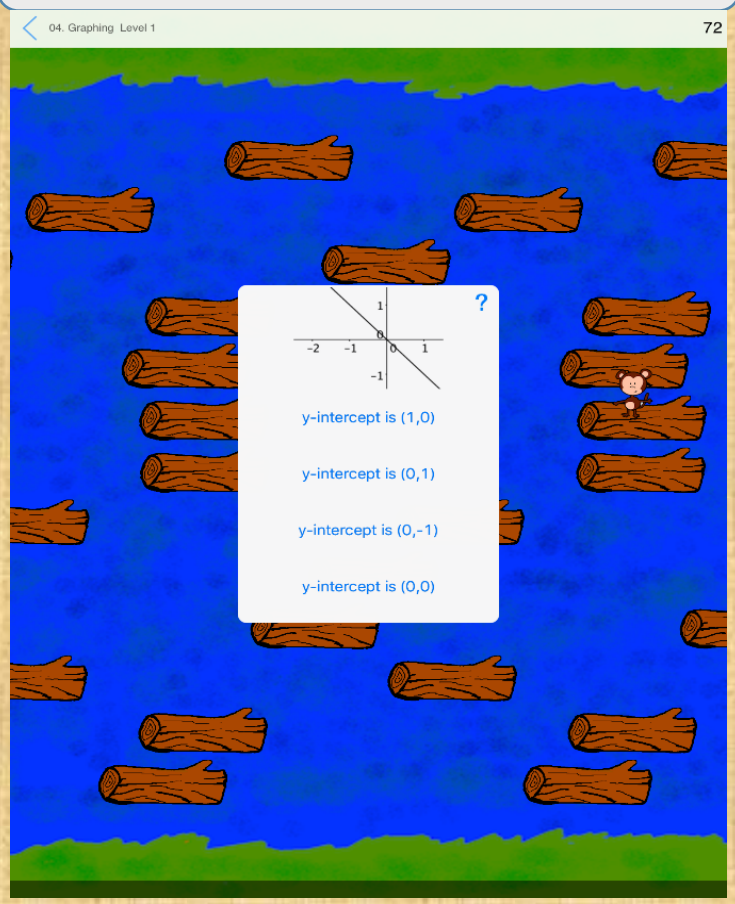
Social Constructivism apps

Collaborative and cooperative: MathChamp
Discussion apps: MathChat

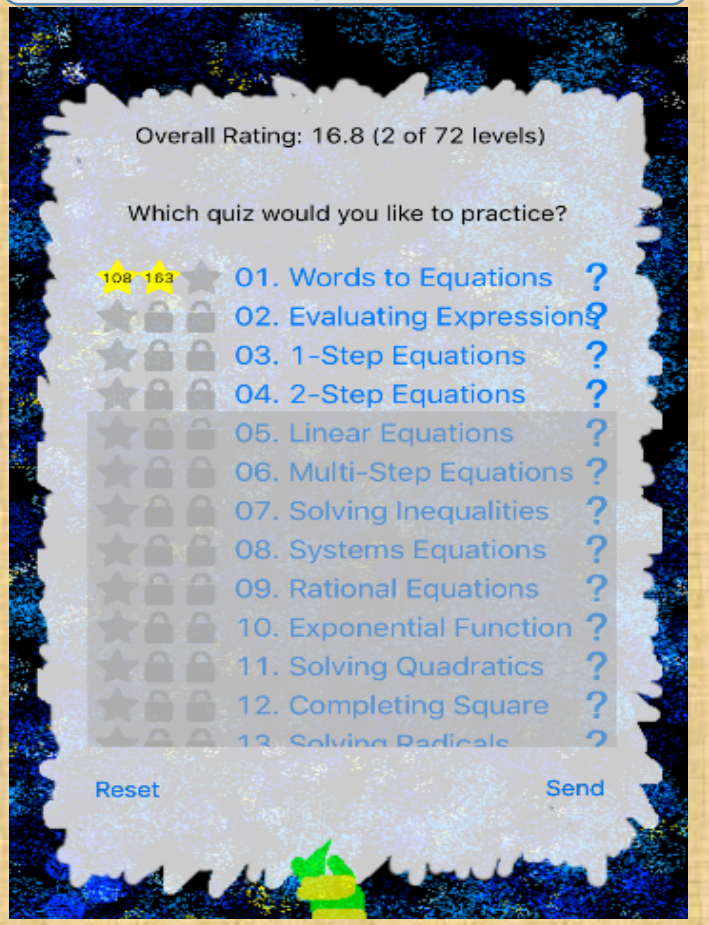
Behaviorism educational math applications

Drill and practice apps with rewards or feedback.

Math 8

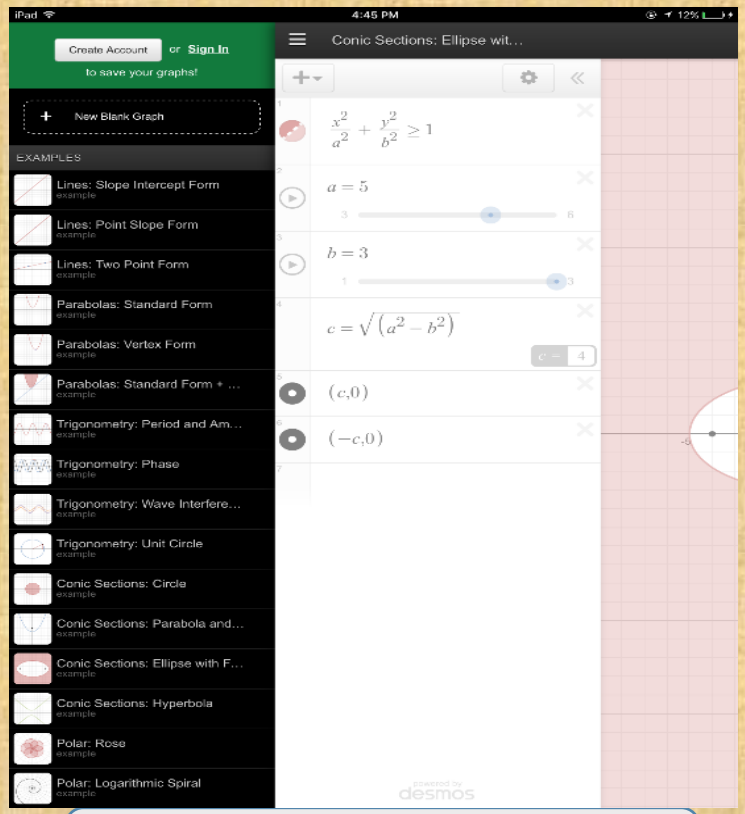


Algebra



Cognitive constructivism educational math Apps

Graphing Calculators, Links the problems to prior knowledge

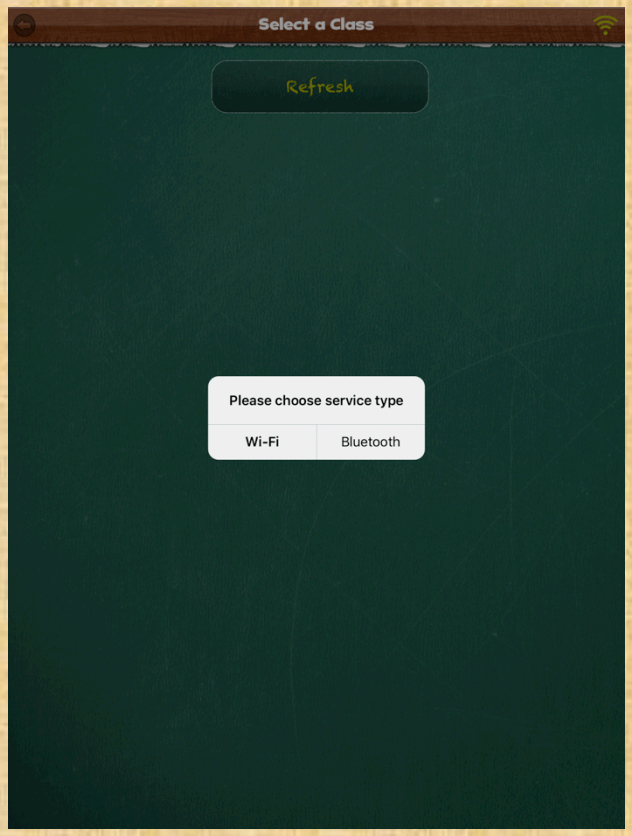


Desmos

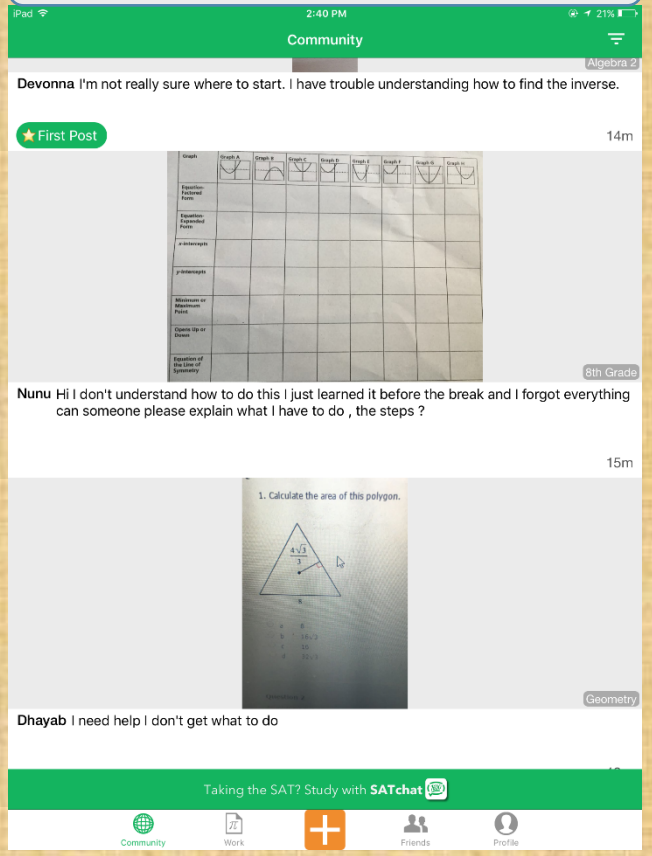
Move the Turtle

Social constructivism educational math apps

Group problem solving and discussion problem solving.



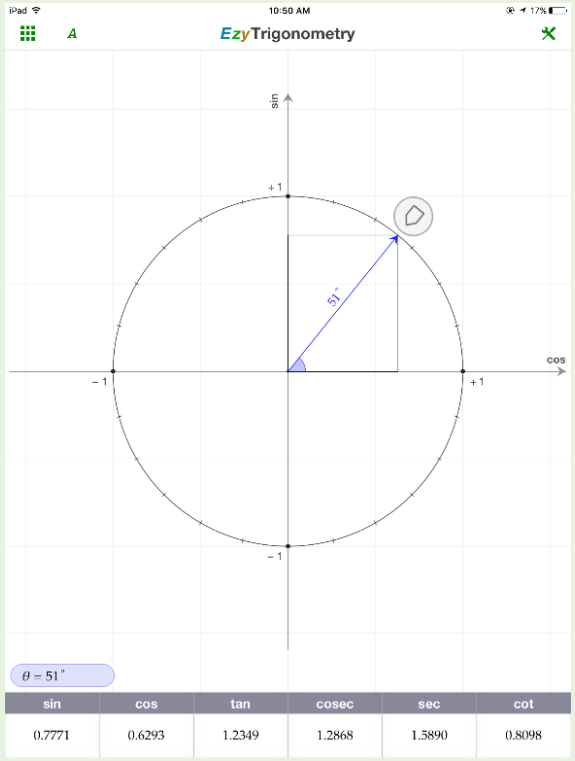
Math Chat

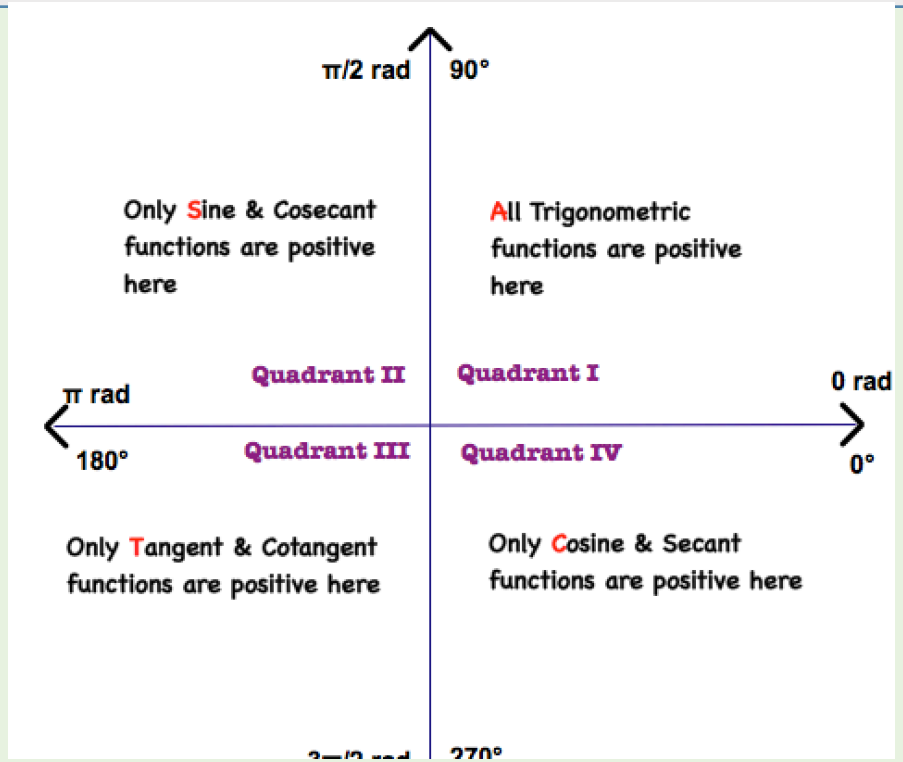


Ezy trigonometry app

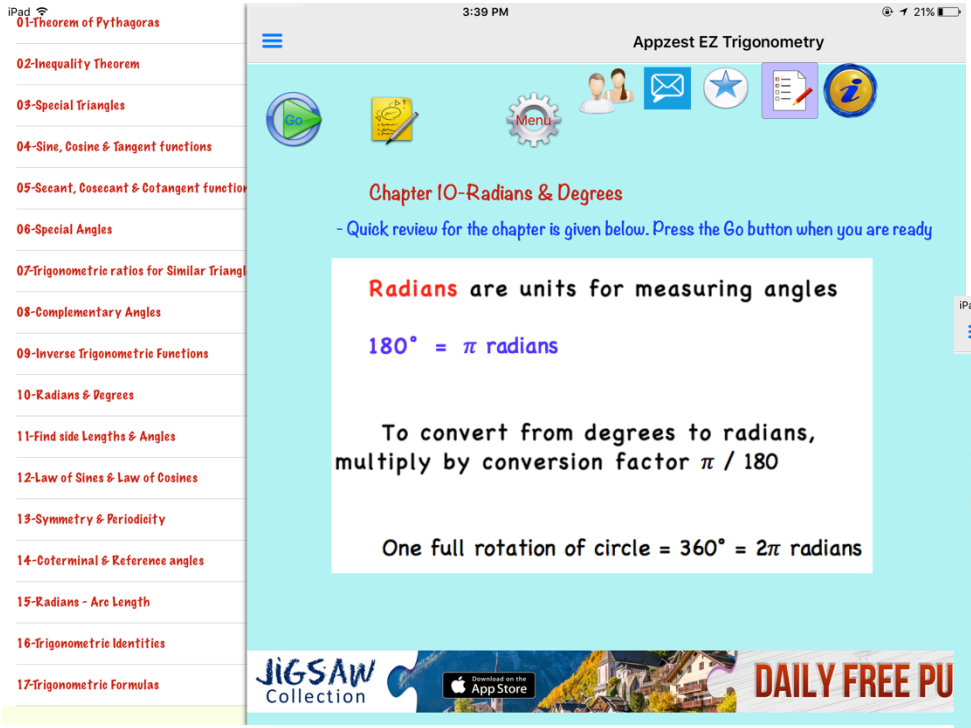
suitable to visualize the values and changes of trigonometric functions at unit circle.

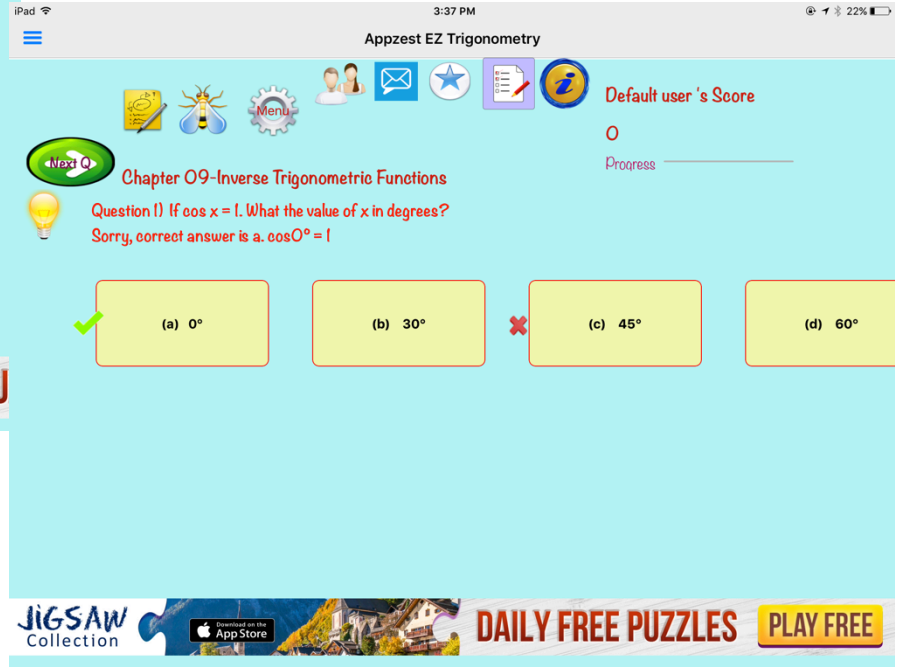
Problem: In which quadrant sin(x), cos(x), tan(x), and cot(x) functions are positive or negative.





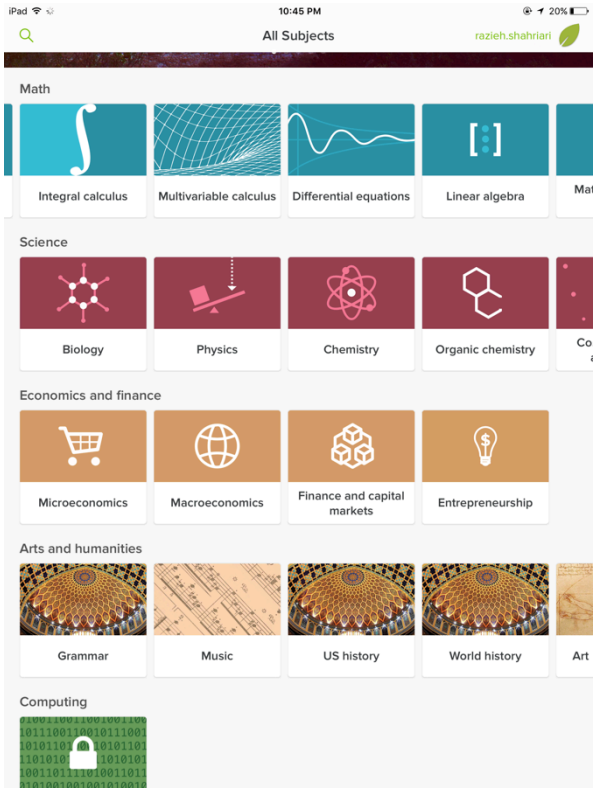
Eztrigonometry app

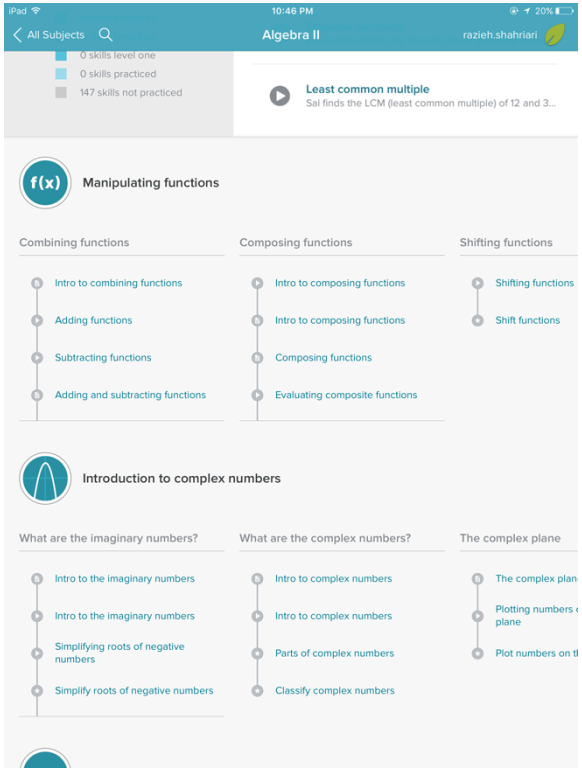


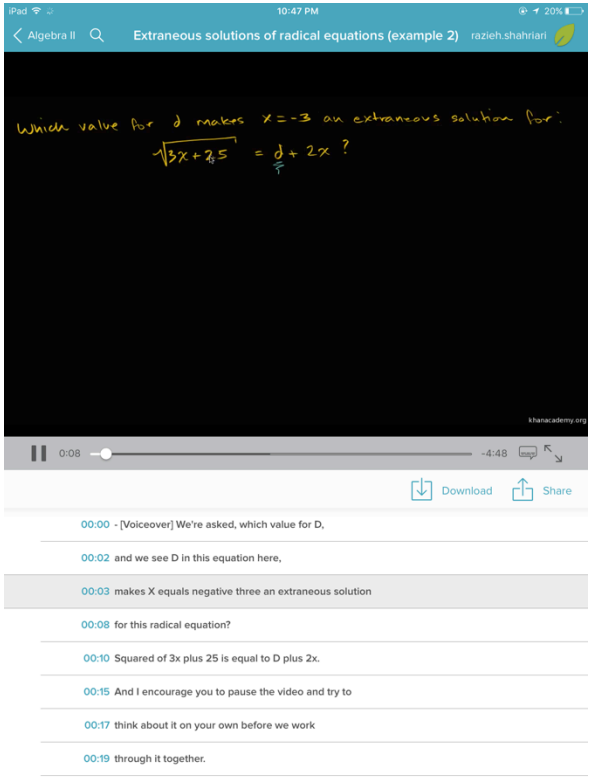


Khan Academy app

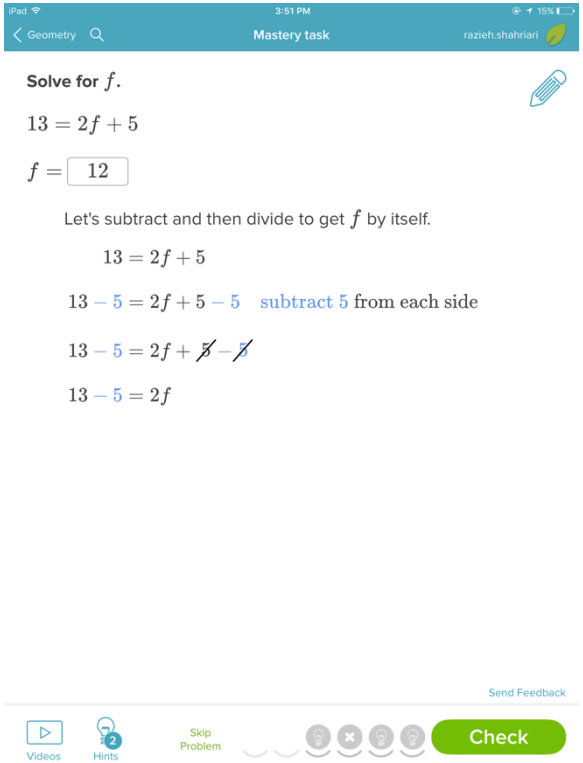
Comprehensive tutorial app which is not restricted to math. Video Lectures can be found for many courses and extensive topics.

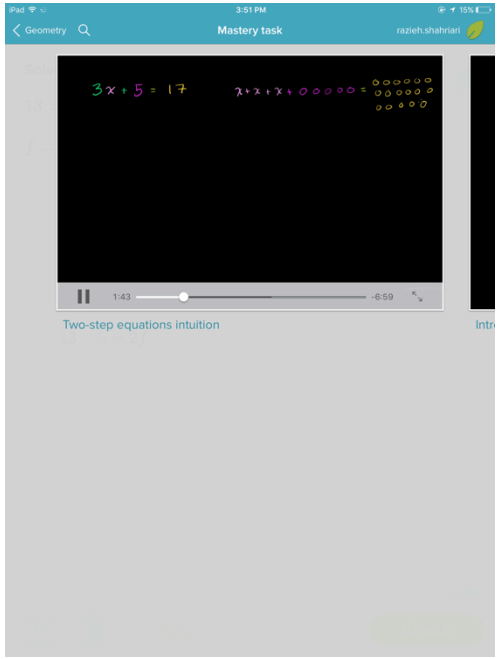






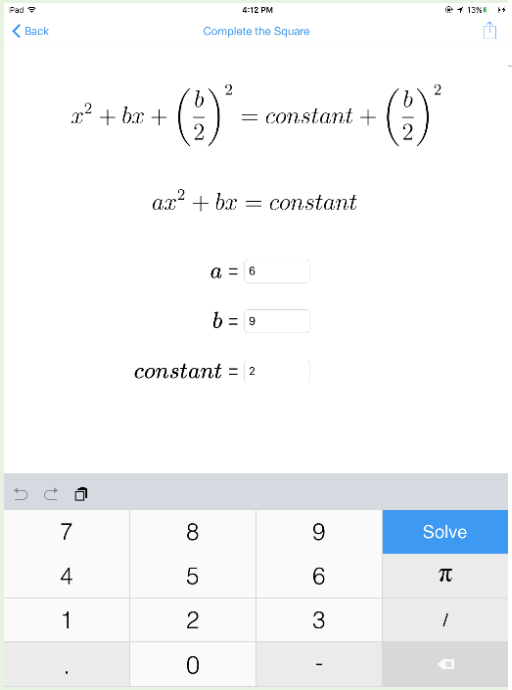
Khan Academy app

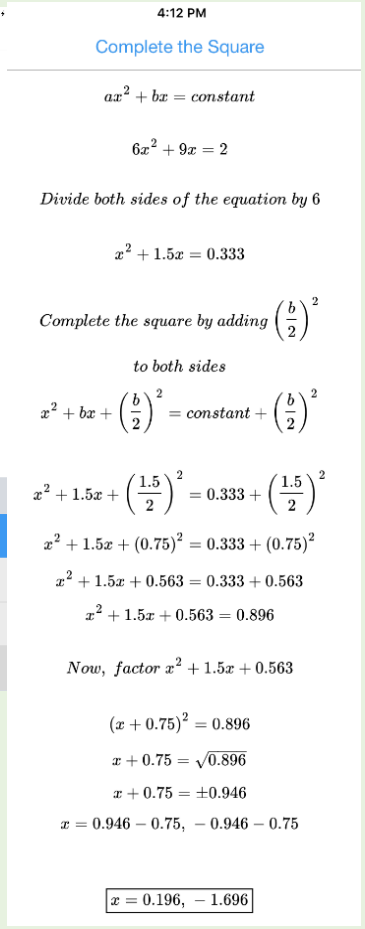


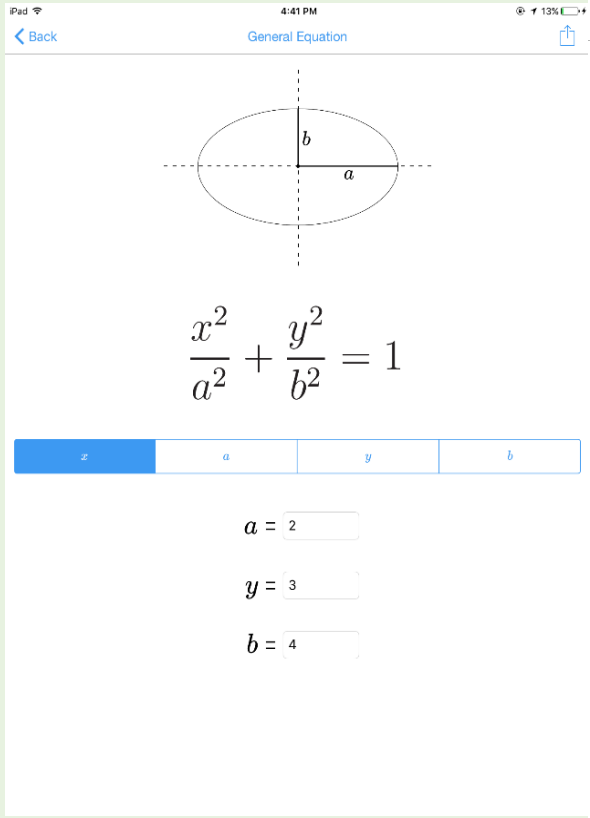


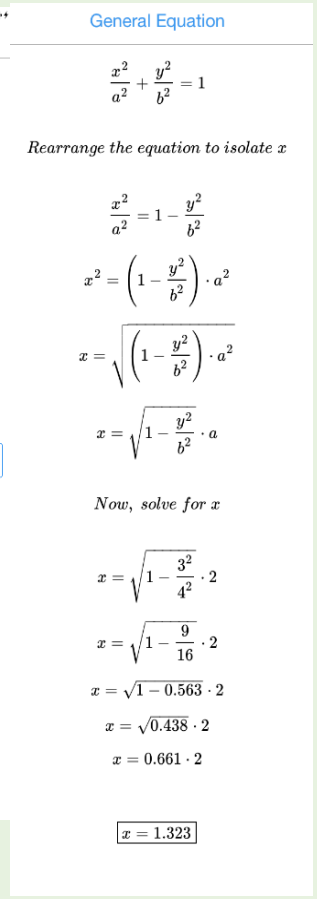
MathKit

MathKit app is a suitable app to solve algebraic equation with explanation





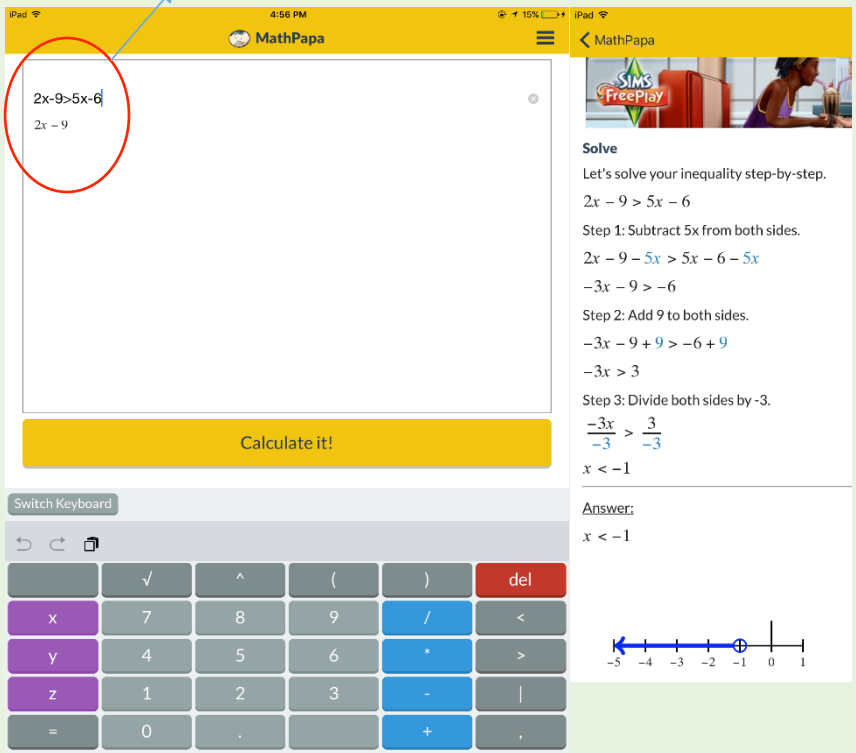




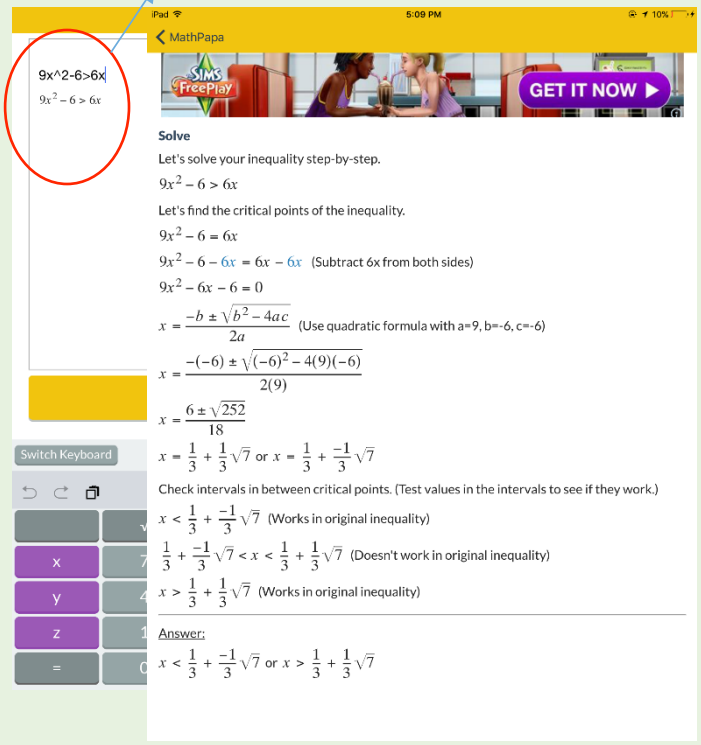
MathPapa

MathPapa app: Simple solver that solves and graphs equations with some explanations.

Linear inequality

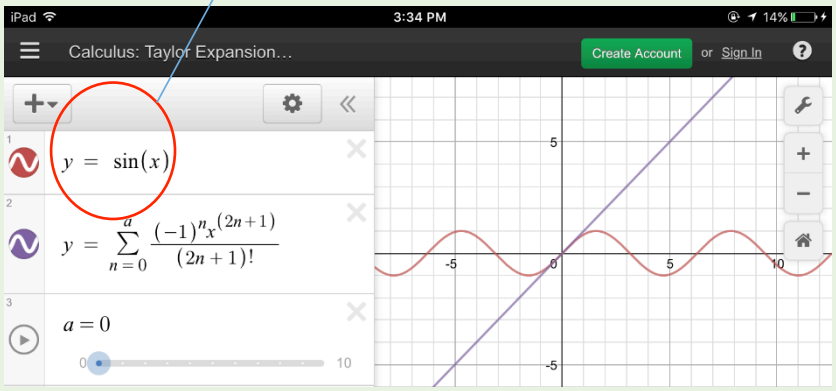


Quadratic inequality

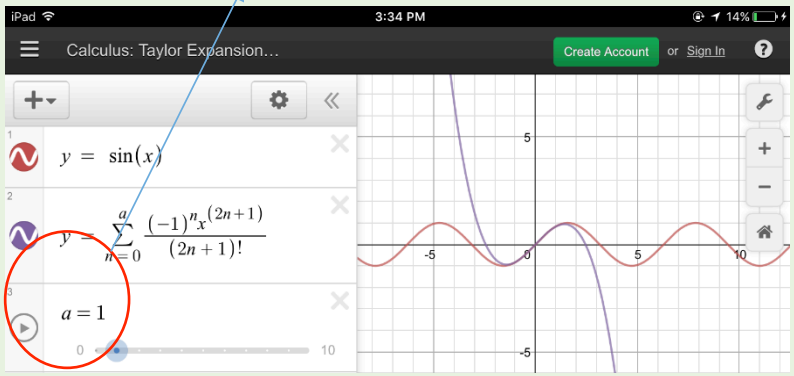


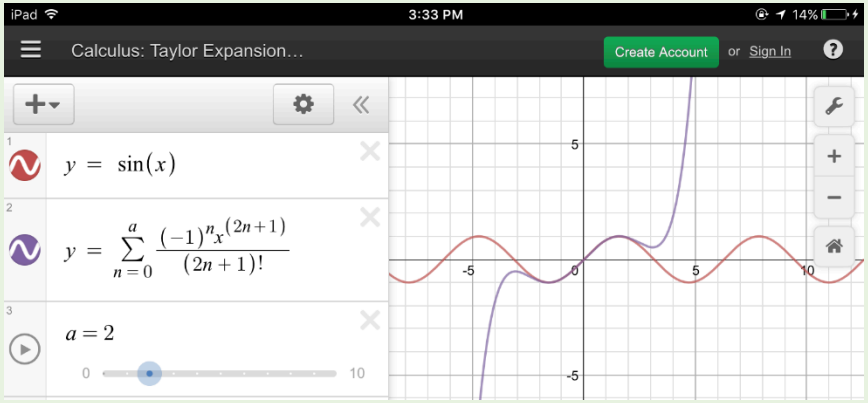
Taylor Expansion of sin(x) using Desmos

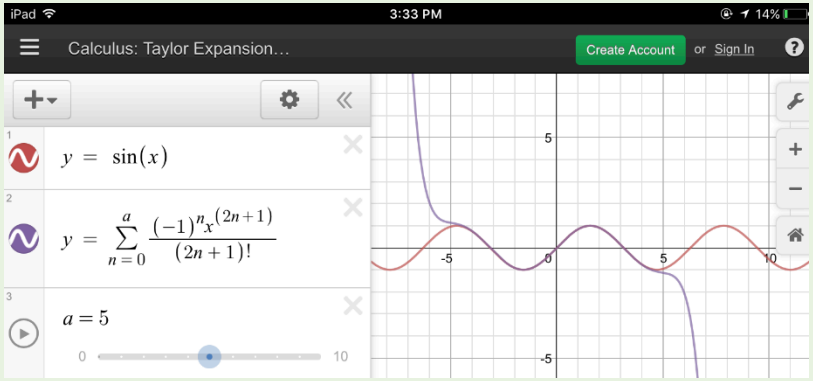
Desired function



Two terms of the expansion



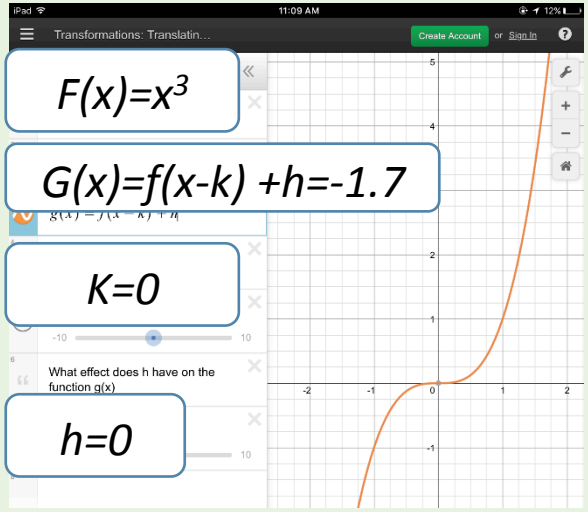


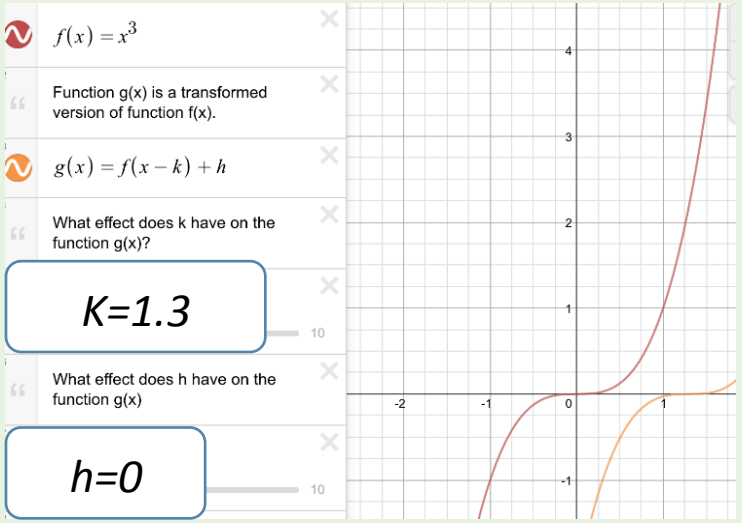


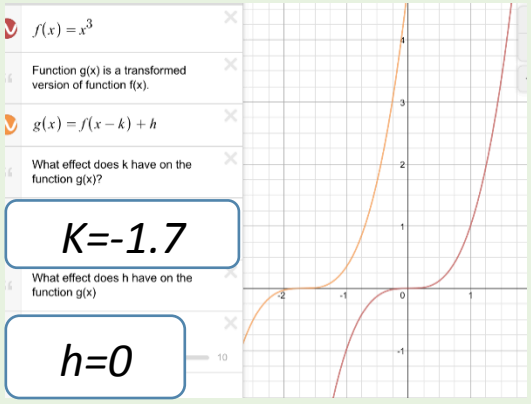
Desmos

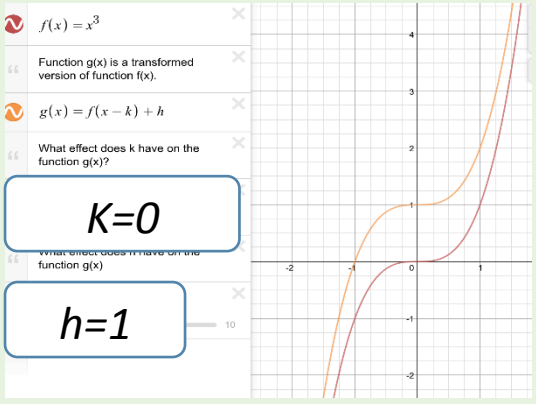
Simple and powerful graphing calculator.

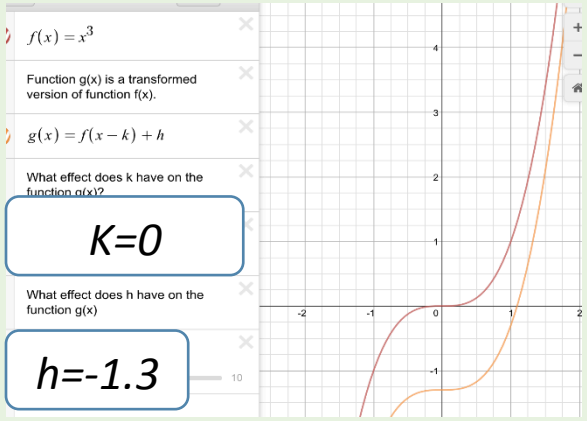
Transformation of a function.





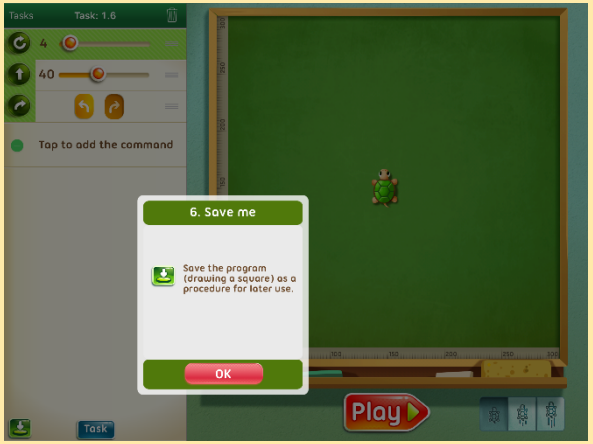






Move the turtle

Build programming skills for youth.
Command move, turn, make sound and also user defined functions.



Criteria for choosing apps

General features

Accuracy
Relevant to curriculum

Learning Models

Behaviorism Theory, Positive and negative feedback
Cognitive C. theory: Connecting to prior knowledge
Social C. : sharing, discussion, team work

Design aspects

Simplicity and navigation
Ease of use, Support , Multimedia usage, Instruction (help)

Choosing apps table

		1	2	3	4	weigh t	Total
General	Accuracy	numerous errors	Error is expected	few errors	Error free		
	Relevant to curriculum	Slightly relevant			Completel y relevant		
Learning Models	Positive and negative feedback						
	Connecting to prior knowledge						
	Effective social Interactions, sharing, discussion, team work						
Design aspect	Simplicity and navigation						
	Ease of use						
	Support						
	Multimedia usage						
	Instruction (help)						

General suggestions in designing apps

Simplicity, user friendly	Simplicity gives good experience to the users and motivation.
Use Learning Theories:	Build your apps based on educational theories.
Specific needs	design your apps for especial individual needs. For example: 10^{th} grade algebra, disables, etc.
Support parents and teachers	Send notification to teachers or parents.

Conclusion

- There are a great potential in using apps in education.
- Due to the large number of apps, choosing a suitable app may be frustrating but with an appropriate decision table choosing app will be feasible.
- To teach each concept teachers may use a separate app
- Much work are required to adapt apps to Learning theories.

Thank you

Questions?