TORRANCE EDUCATION FOUNDATION

APPLICATION

TEF STEM Initiative Grant

Applicant(s): Jennifer Haney Job Title: teacher

School Site: West High School Principal: Kara Heinrich

Contact Information:

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Program/Event (Please select 1 per application)

- O Engineering ** After-School Club
- O First Lego League/ Robotics
- O Family STEM Night
- O Hour of Code — none - see attached
- O Math Counts
- O Science Olympiad
- O CyberPatriots
- O Stellar Xplorers

** Applicants may submit separate applications for multiple programs/events.*

*** Applicants for Engineering After-School Club, please include program title & curriculum/description*

Did this school receive a TEF STEM Initiative Grant for this program/event last year? ☐ YES ☒ NO

Number of years program/event has been in place at your schools:

_____ 0 years (new) _____ 1 year X 2 or more years

Targeted Grade Level(s) 11-12 Estimated number of participating students: 60

Estimated schedule of events and planning (ex: tentative dates for future information meeting, club meeting times, **competitions or event dates**, etc.)

see attached

wants to celebrate and support grant winners!

*Grant winners are **required to notify** TEF (Admin@TorranceEducationFoundation.org) of future events, competitions, and ceremonies related to the approved program/event. Please give at least two weeks notice.*

J. Haney — Applicant Signature 9/26/18 — Date

Principal Signature 9/26/18 — Date

** Completed grant applications should be scanned and emailed to Admin@TorranceEducationFoundation.org by 3:00pm, September 28th.*

APPLICATION TEF STEM Initiative Grant

Though this application does not fall under any of the 8 categories listed above, Susan Swinburne talked with my colleague at West High and encouraged us to submit the grant. It will supply kits of K'Nex to Calculus students, who will collaborate with their peers and other Calculus students, and in the future, hopefully Calculus students across the district. It is a sustainable project with the K'Nex pieces being used over and over again from year to year.

OBJECTIVE: In groups of four or five, Advanced Placement Calculus AB students will design and build an original amusement park ride using K'Nex pieces and a motor. In the design and building stage, students will work together to problem solve structural issues within their design that affect the safety of the riders. After completion of the build, students will identify and explain in written narrative form at least three practical uses for the calculus concepts studied during the course in relation to their ride, as well as calculating the velocity of the ride at various locations. The narrative and calculations will make practical connections between real-life applications and the Calculus concepts studied during the course. Students will create a marketing plan for their ride that discusses the safety features, forces experienced by the riders, velocity, dimensions, construction considerations, and features that would attract potential amusement park riders to the ride. To address the marketing components, students will need to research amusement park rides and current amusement park marketing plans on school provided Chrome books. Throughout the project students are connecting Calculus learning to their own experiences at amusement parks, as well as delving behind the scenes in some of the ways their favorite rides work. Students will adjust their design to be safe for riders, just as is done at amusement parks. The practical applications for Calculus will make the learning of the year relevant to their lives.

COLLABORATION: My ultimate goal is for a STEM project such as this to be completed in all AP math courses on campus. Two AP Calculus AB courses taught by Emma Biggs already do the project, and I would like to begin it this year to initiate a sort of "competition" among all AP Calculus AB courses at West High. I also would like to share this idea with teachers at the other high schools as an inspiration for integration of engineering, science, writing, and presentation in mathematics classrooms.

SUSTAINABILITY: The K'Nex kits are durable kits that can be used for many years to come. As recommended from the author of the inspiration article, I will start the project with students taking an inventory of the K'Nex pieces in each kit. With an initial inventory, students would be accountable for their pieces after the project and kits would be organized with all parts accounted. With an inventory, this project is sustainable for years to come and can be passed down to future Calculus teachers.

COST: Ultimately, I need 15 sets of K'Nex to make this project doable with my two classes of Calculus students. Being that the K'Nex sets each cost $265.00, I am asking for $795.00, enough to buy 3 sets for my classroom. Of course, I will ultimately need $3975 to make this project feasible. I will use the $1000 so graciously donated to me by TEF for Teacher of the Year as part of that $3975.

MORE INFORMATION

To assess students on this project, I will use the math department's rubric which scores students understanding, strategies, reasoning, and procedures on a 4-point scale. The expectation is that each group will:
1) Design and build an amusement park ride
2) Write a narrative describing 3 connections between the Calculus content explored during the school year and the amusement park ride designed.
3) Calculate the velocity of their ride at three locations
4) Create a marketing campaign using technology or poster board including safety features, forces experienced by the riders, velocity, overall dimensions, construction considerations, and features that would attract potential amusement park riders.
5) Share their ride, marketing campaign, Calculus connections, and velocities in a class presentation.
Each portion of the assignment will be scored using the 4-point scale described above with modifications for the marketing portion.

Project Objectives:
For students:
1) To make connections between Calculus concepts learned during the school year and possible careers.
2) To participate in the design, build, and editing of a project.
3) To engage in mathematics in a real world context.
4) To connect mathematics to other disciplines through writing and marketing.
5) To engage in research using the internet.
6) To edit their work (amusement park ride and calculations) based on research and experimentation.
7) To have fun with mathematics and take the route work out of the AP Calculus program.

These project objectives require students to critical think through their design and building process because they will need to edit their designs for feasibility and safety. This problem-solving component is very like that engineers and architects use in their designs. Students will only have so many pieces of K'Nex for their design, just like engineers only have so much of a budget available to them. In marketing the project, students will need to think like artists in making their rider experience a thrilling and/or enjoyable ride. The marketing campaign will also be similar to that created by project managers when they respond to a request for a proposal for some given work, such a new amusement park ride. These Advanced Placement students are held to high expectations throughout the college level coursework. The listed objectives take them out of the textbook and require application of concepts learned, as well as imagination. The high expectations of connecting mathematics to science.

Designing amusement park rides is a real world application of mathematics and science. These applications are so rarely given time in traditional courses due to an overwhelming amount of content to be covered in a finite time. Through this project students are exploring careers involving architecture, engineering, construction, simulation, and mathematics beyond reading about them in a textbook. Beyond this, students are also exploring marketing careers, which involve presentation and artistic skills.

In the future, more funds may be needed to purchase more sets of K'Nex if class sizes increase or other Calculus teachers also want to complete the project. When students present their projects to the class, I will open my classroom to other teachers and administrators to view the work students have done. If permission is granted, I will film the presentations to share with the math department to give them ideas about how to create STEM elements in their curriculum.