



MATHEMATICS IN CAREERS

Investigation - Collison

Key career focus for this investigation: Engineer and design Related career areas: Auto mechanics



THINKING ABOUT CAREERS

- Brainstorm information technology professions you can think of where maths is frequently used. Use <u>https://joboutlook.gov.au</u> to explore engineering related career pathways that include use of mathematics. *How is maths used in these scenarios? What maths is used in these scenarios?*
- This task focuses on how maths is used in Engineering through investigating a scenario to avoid a collision.
- Explore careers such as mechanical engineering to discover how maths is used in these. For a more extensive list of careers related to this task, with a maths / science focus, refer to the table at the end of the task and explore the maths used in these jobs.

MATHEMATICS IN EVERYDAY LIFE AND CAREERS

Mathematical focus for this investigation

- Solving simple equations arising from formulas
- Re-arranging expressions to make a specified variable the subject
- Calculate speed, time, and distance
- Represent word problems with simple linear equations and solving them to answer questions.
- Comparing and analysing data to draw conclusions
- Kinetics (physics)

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- A formula is a mathematical relationship expressed in variables.
- Many people use formulas every day to calculate unknown values.
- Formulas can be used to calculate or convert different values such as Celsius degrees to Fahrenheit or currency exchange rates.

Brainstorm and share scenarios where this mathematics may be used in engineering to solve problems.





INVESTIGATION BACKGROUND

As an engineer working for Ford, you are required to simulate various scenarios. From the scenario you have been given below, investigate the point of collision of the two vehicles and after working through the various parts analyse how realistic this situation is?



YOUR INVESTIGATION

As Future Ford Driver Assist Technologies (DAT) engineers, your task is to compare 3 vehicles and rank them in terms of their safety for vulnerable road users. You are then to provide a recommendation of what you would do to improve the performance of the vehicle in terms of VRU protection.

PART 1

Determine the point of collision of vehicle A and B. Assumptions:

- Reaction time of vehicle A: 1s, vehicle B: 1.5s
- 2D elastic collision
- Average mechanically applied pre-collision deceleration rate of vehicle A: $7m/s^2$, vehicle B: $6.5m/s^2$

PART 2

Determine the velocity of each vehicle after the collision, ignoring gravitational potential energy.

PART 3

Imagine a perfect scenario where these 2 vehicles 'touch' but do not collide, what would be the average mechanically applied break force of each vehicle?











ADDITIONAL INFORMATION - FORMULAE

Velocity

v = u + atv = final velocity, u = initial velocity, a = acceleration, t = time

Momentum

p = mv
p = momentum, m = mass, v = velocity

Kinetic energy

$$KE = \frac{1}{2}mv^2$$

KE = kinetic energy, m = mass , v = velocity

Force

F = maF =force, m =mass , a =acceleration

EXTENSION OR ADVANCED INVESTIGATION - EXTENDING PROMPTS

Brainstorming question: determine three other factors affecting the safety of the passengers in real world scenario and explain their effects.

Further investigation:

- How realistic is this situation?
- Investigate what is the steepest road in the world.
- How does the scenario you have been presented with compare with this?













CAREERS RELATED TO THIS INVESTIGATION

GENERAL ENGINEERING					
Career description	Key skills required	More information			
 Engineers are scientists, inventors, designers, builders, and great thinkers. Engineering covers: Mechanics and the construction of tools and machines of all sizes The creation of cars, trains, ships, boats, aircraft and all other vehicles The design and production of chemical compounds Operations of businesses and cities Entertainment, industry, construction, transport, healthcare, and defence. 	 The scientific method Social, cultural, and economic awareness Mathematics Biology, chemistry, physics, and other areas of science Creativity Teamwork 	www.engineersaustralia.org.au/ For-Students-And-Educators/Engi- neering-Careers/What-Is-Engineering www.glassdoor.com/blog/guide/ types-of-engineering-jobs/			
MECHANICAL ENGINEERIN	NG Key skills required	More information			
Mechanical engineers design, develop, build, and test. They analyse their work using the principles of motion, energy, and force — ensuring that designs function safely, efficiently, and reliably, all at a competitive cost.	 Mathematics and physics Collaboration Good problem-solving skills Creativity Computer software skills 	www.glassdoor.com/blog/guide/me- chanical-engineering-skills/ www.mtu.edu/mechanical/engineer- ing/			
MECHANIC					
Career description	Key skills required	More information			
 A mechanic performs maintenance, diagnostic testing, repairs, and inspections of small trucks and cars. Careers include: Auto mechanic Vehicle inspector Auto body repair technician Auto electrician 	 Technical aptitude Problem solving skills Good work ethic Customer service skills Auto mechanic knowledge Diagnostic and mechanical skills 	https://careerhq.com.au/careers-da- tabase/job_details/270/light_vehi- cle_mechanic			











CAREERS RELATED TO THIS INVESTIGATION

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Career description	Key skills required	More information			
An automotive designer drafts layouts of automobile components, assemblies and systems using sketches, models, and prototypes. They determine factors that may affect design proposals by using previous car models, understanding manufacturing limitations and collaborating with automotive engineers.	 Creativity Competent software skills Good math and physics skills Interpersonal skills Strong drawing and sculpting skills 	<u>www.theartcareerproject.com/be-</u> <u>come/automotive-designer/</u>			
OTHER RELATED CAREERS TO EXPLORE					
Electrical engineeringCivil engineering					

٠ Auto engineering

For an overview of engineering being a priority industry and sector, visit: https://djpr.vic.qov.au/priority-industries-sectors/professional-services



CAREERS ACTIVITIES

THE 10 BEST RATED JOBS OF 2021					
Rank	Career	Median salary	Projected growth		
1	Data Scientist	\$98 230	33%		
2	Genetic Counsellor	\$85 700	21%		
3	Statistician	\$92 270	35%		
4	Medical Services Manager	\$104 280	32%		
5	Mathematician	\$110 860	33%		
6	University Professor	\$80 790	9%		
7	Operations Research Analyst	\$86 200	25%		
8	Information Security Analyst	\$99 730	31%		
9	Actuary	\$111 030	18%		
10	Software Engineer	\$110 140	22%		

Data from <u>Careercast.com</u>.

Select one of the careers, from either of the tables above, that interests you and find out:

- What are the tasks involved in this career? What may a typical day look like? ٠
- What level of education or qualifications do you need to do this career? ٠
- What are some other similar or related careers?
- What mathematics skills would be used in this career?
- Where does the career you have selected, to investigate, rank according to careercast.com? •
- How many people in Australia are currently employed in this career (or field)?

INDUSTRY PARTNER

This project was produced collaboratively between The Mathematical Association of Victoria (MAV) and FORD

Ford Motor Company of Australia Pty Limited is a subsidiary of Ford Motor Company, founded in Geelong, Victoria, in 1925. The company designs, engineers, and imports award-winning and best-selling cars, SUVs and trucks, including Puma, Escape, Everest, Focus, Fiesta ST, Ranger, Ranger Raptor, Mustang, Mustang Mach 1 and Transit commercial vans. Australia is a key product development hub for Ford, with the company investing more than \$2.5 billion in research and development in Australia between 2016-20. More than \$500 million is expected to be invested in our Australian operations in 2021.

Ford is Australia's largest automotive employer, with a team of over 2,500 engineers, designers, technical, automotive and other specialists working at four locations across Victoria. Australia-based engineers and designers lead the development of award-winning vehicles sold in more than 180 markets globally, such as the Ford Ranger pickup and Ford Everest SUV.

www.ford.com.au www.ford.com.au/about-ford/careers

FURTHER CAREER REFERENCES

Australian Jobs Report 2021

www.nationalskillscommission.gov.au/australian-jobs-report

An overview of trends in the Australian labour market to support job seekers and employment service providers, career advisers, those considering future training and people interested in labour market issues.

Business Victoria Future Industries

https://business.vic.gov.au/grants-and-programs/future-industries Future Industries is about supporting investment in high-growth industries through industry excellence and development projects, including establishing collaborative networks and building supply chain readiness capabilities.

Career Education

www.education.vic.gov.au/school/teachers/teachingresources/careers/Pages/default.aspx Career Education teaching resources to help teach students to make informed career decisions and equip themselves for the world of work.

CEAV Online Learning Resources

https://ceav.vic.edu.au/media/250615/careers-in-the-construction-technology-industries-student-resource.pdf Designed to enable students to attend a virtual Industry Immersion Experience, these online resources will help students discover more about Victoria's priority growth industries and give them the opportunity to reflect on their skills, interests and undertake career planning and exploration.

Jobs Victoria

www.jobs.vic.gov.au

JobOutlook

www.joboutlook.gov.au Relevant and current labour market trends and career information.

MyFuture

www.myfuture.edu.au A database of over 600 careers.

National Careers Institute

www.dese.gov.au/nci

The National Careers Institute (NCI) ensures Australians have access to reliable and accurate careers information, resources, and support.

