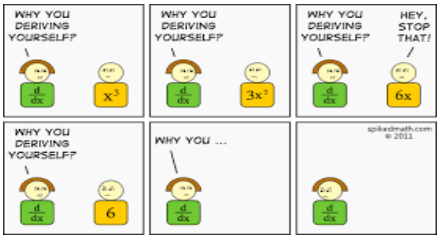
Week 12
Term 4
2023

HAWKER COLLEGE
Engage | Inspire | Achieve

MM2: Introduction to Differential Calculus

Goals



This fortnight we will be:

- Finding the gradient function (derivative) of polynomial functions using the power rule
- Differentiating using power rule
- Locating stationary points: f'(x)=0
- Finding equation of tangent and normal lines to a curve

Theoretical Components

Resources:
Maths Quest Year 11 Chapter 9

Derivative as slope of a tangent line:
https://youtu.be/ANyVpMS3HL4

Knowledge Checklist:

- what is a rate?
- constant rates
- variable rates
- average rates of change
- instantaneous rates of change
- interpret graphs that illustrate rates of change
- equations of tangents
- what is a limit?
- evaluating limits
- what is a gradient function?
- what is the x-intercept of a gradient function?
- power rule
- finding gradient functions by sketching
- finding gradient functions by using the rule
- finding gradient functions using your CAS

The derivative of $f(x)=x^2$ for any x
https://youtu.be/HEH_oKNLgUU

Example of finding gradient function from first principle for f(x) = 5x + 1

https://www.youtube.com/watch?v=6rJ9hDUEeoQ

Practical Components

Rule 1. If $f(x) = x^n$, then $f'(x) = nx^{n-1}$.

Rule 2. If $f(x) = ax^n$, then $f'(x) = nax^{n-1}$.

Rule 3. If $f(x) = c$, then $f'(x) = 0$ (where c is constant).

Rule 4. If $f(x) = g(x) + h(x)$, then $f'(x) = g'(x) + h'(x)$

Ex 9D Finding derivatives by rule
All questions 13 – 25

Ex 9E Rates of Change - Applications
Qs 2, 4, 5, 6, 7, 11 – 17

Investigation

See next page.

Make sure you prepare your Journal Entry for Weeks 9-10, Week 11 and Week 12 if you haven't already.

QFO
Quiz/Forum/Other

Mathspace task – Derivative applications –

https://mathspace.co/student/tasks/TopicCustomTask-654947/

MM2 INVESTIGATION Week 12

A crash test car, with a test dummy inside of it, will travel towards a brick wall 100 metres away. The car's distance from its starting point can be modelled with the function d(t) = $7.5t^2$ where t is *time in seconds.*

1. Determine how many seconds (to two d.p) it will take for the car to collide with the brick wall.

2. Find the car's average velocity between t = 0 and the time of impact.

3. Find the car's velocity at the time of impact (by calculating the instantaneous rate of change).

4. Find the car's average acceleration between t = 0 and the time of impact.

5. Find the car's acceleration at the time of impact (by calculating the instantaneous rate of change of the velocity at the time of impact).

6. Using Newton's second law, F (force, in Newtons) = m (mass, in kg) multiplied acceleration (in metres per second squared), calculate the amount of force applied to the car at the point of impact, if the car has a mass of approximately 2,000 kg.

7. The car can resist 50,000 Newton's of force without causing significant damage to the driver. Will the crash test cause any significant damage to the dummy within?

8. The function for the distance of the car from the starting point changes to $15t^2$. Will the dummy face significant damage from the crash now?