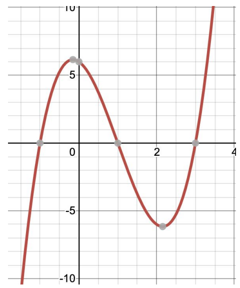
Self-Assessment for Grade 12 Calculus and Vectors (MCV4U)

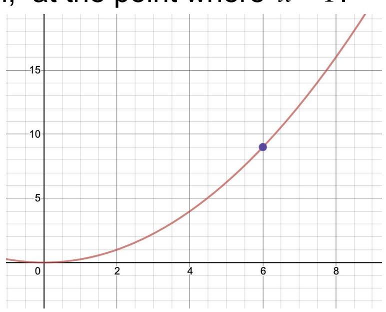
Students who are registered for Grade 12 Calculus and Vectors (MCV4U) may benefit from a self evaluation and review of the following sample of expectations from Grade12 Advanced Functions (MHF4U).

The questions in this self-assessment reflect some of the key ideas learned in prerequisite courses. They do not represent the problem solving approach or the rich experience that students would be exposed to in a classroom. The intention is for students to revisit some key concepts and, if needed, access review materials in an informal environment at a pace that is comfortable for the student.

Concept(s)	Sample Question	How comfortable do you feel with this concept?	Link(s) to explore concept further
I can use the laws of logarithms to simplify and evaluate numerical expressions	1. Evaluate. a) $\log_2 16^3$ b) $\log_2 8^{0.5}$ c) $2\log 5 + \frac{1}{2}\log 16$ d) $\log_3 405 - \log_3 5$	☐ **Very comfortable** ☐ **Somewhat comfortable** ☐ **Not at all comfortable**	Properties of Logs
I can recognize the relationship between an exponential function and the corresponding logarithmic function to be that of a function and its inverse,	2. Is the inverse of $y = 2^x$ a function? Explain your answer using algebraic and graphical reasoning.	☐ **Very comfortable** ☐ **Somewhat comfortable** ☐ **Not at all comfortable**	Introduction to Logarithms Video

I can describe the roles of the parameters a, k, d and c in terms of transformations on the graph of f(x) = $\log_{10}$x	3. If $f(x) = \log_3 x$ sketch the graph of $g(x) = 2f(2(x+1)) - 3$	☐ **Very comfortable** ☐ **Somewhat comfortable** ☐ **Not at all comfortable**	Logarithmic Functions - Part 5 Video
I can solve exponential and logarithmic equations	4. Solve. a) $5^t = 250$ b) $4^{x+5} = 64^x$ c) $\log_4(x+2) = 3$	☐ **Very comfortable** ☐ **Somewhat comfortable** ☐ **Not at all comfortable**	Solving Exponential Equations Video
I can solve linear and quadratic trigonometric equations, with and without graphing technology, for the domain of real values from 0 to 2π	5. Solve the equation $2\cos^2 x = \sin x + 1$ over the interval $0 \le x \le 2\pi$ Leave your answers as exact values.	☐ **Very comfortable** ☐ **Somewhat comfortable** ☐ **Not at all comfortable**	Introduction to Trigonometric Ratios and Special Triangles Video Solving Trigonometric Equations Video
I can sketch graphs of y = a sin (k(x – d)) + c and y = a cos(k(x – d)) + c by applying transformations to the graphs of f(x) = sin x and f(x) = cos x with angles expressed in radians	6. If $f(x) = \sin(x)$, sketch the graph of $g(x) = -f\left(2\left(x + \frac{\pi}{6}\right)\right) - 1$	☐ **Very comfortable** ☐ **Somewhat comfortable** ☐ **Not at all comfortable**	Graphs of Primary Trigonometric Functions Video

I can describe key features of the graphs of polynomial functions	7. Describe key features of the graph of $y=f(x)$ given below. (End behaviour, intervals of increase and decrease, and where $f(x)>0$  	☐ **Very comfortable** ☐ **Somewhat comfortable** ☐ **Not at all comfortable**	[Characteristics of Polynomial Functions Video]
I can sketch the graph of a polynomial function given in factored form using its key features	8. Sketch the graph of $f(x)=-2(x+3)^2(x-1)$	☐ **Very comfortable** ☐ **Somewhat comfortable** ☐ **Not at all comfortable**	[Graphs of Polynomial Functions in Factored Form Video]
I can sketch the graph of a simple rational function using its key features, given the algebraic representation of the function	9. Sketch the graph of $f(x)=\frac{2x+1}{x+2}$	☐ **Very comfortable** ☐ **Somewhat comfortable** ☐ **Not at all comfortable**	[Rational Functions of the Form y=ax+b over cx+d]

I can make connections between instantaneous rates of change and average rates of change	10. Describe how the average rate of change can be used to determine the instantaneous rate of change in any function.	☐ **Very comfortable** ☐ **Somewhat comfortable** ☐ **Not at all comfortable**	Determining Average and Approximating Instantaneous Rates of Change for Linear, Polynomial and Rational Functions Video
I can make connections, between the slope of a secant on the graph of a function and the average rate of change of the function over an interval	11. Determine the average rate of change graphically and algebraically for the function $f(x) = 2x^2 - 5$ from $x = 1$ to $x = 2$.	☐ **Very comfortable** ☐ **Somewhat comfortable** ☐ **Not at all comfortable**	Determining Average and Approximating Instantaneous Rates of Change for Linear, Polynomial and Rational Functions Part A Video
I can determine the approximate slope of the tangent to a given point on the graph of a function and make connections to average and instantaneous rates of change	12. Determine an approximation for the instantaneous rate of change using two different methods for the below function, at the point where $x = 1$. 	☐ **Very comfortable** ☐ **Somewhat comfortable** ☐ **Not at all comfortable**	Determining Average and Approximating Instantaneous Rates of Change for Linear, Polynomial and Rational Functions More Golf Video Generalizing Our Results: Determining Average and Approximating Instantaneous Rates of Change for Linear Polynomial and Rational Functions Video

Solutions to Sample Questions

1. Evaluate.

a) $\log_2 16^3 = 12$

b) $\log_2 8^{0.5} = 1.5$

c) $2\log 5 + \frac{1}{2}\log 16 = \log 5^2 + \log 16^{\frac{1}{2}} = \log(25 \times 4) = \log 100 = 2$

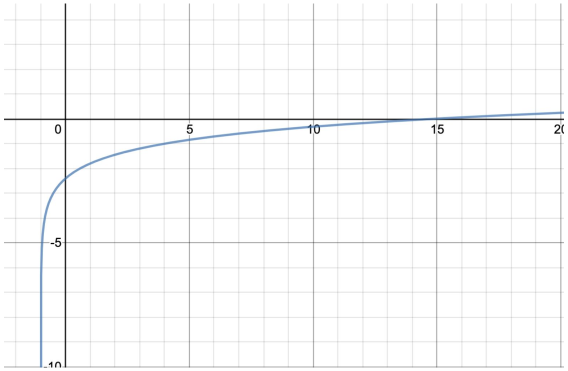
d) $\log_3 405 - \log_3 5$

$= \log_3\left(\frac{405}{5}\right) = \log_3(81) = 4$

2. Is the inverse of $y = 2^x$ a function? Explain your answer using algebraic and graphical reasoning.

Yes. For every x there is only one y-value. The function also passes the vertical line test.

3. If $f(x) = \log_3 x$ sketch the graph of $g(x) = 2f(2(x+1)) - 3$



4. Solve.

a) $5^t = 250$

$t = \log_5 250 = 3.43$

b) $4^{x+5} = 64^x$

$4^{x+5} = 4^{3x}$

$x + 5 = 3x$

$x = 2.5$

c) $\log_4(x+2) = 3$

$x + 2 = 4^3$

$x + 2 = 64$

$x = 62$

5. Solve the equation $2\cos^2 x = \sin x + 1$ over the interval $0 \le x \le 2\pi$ Leave your answers as exact values.

$$2\cos^2 x - \sin x - 1 = 0$$

$$2\left(1 - \sin^2 x\right) - \sin x - 1 = 0$$

$$2\sin^2 x + \sin x - 1 = 0$$

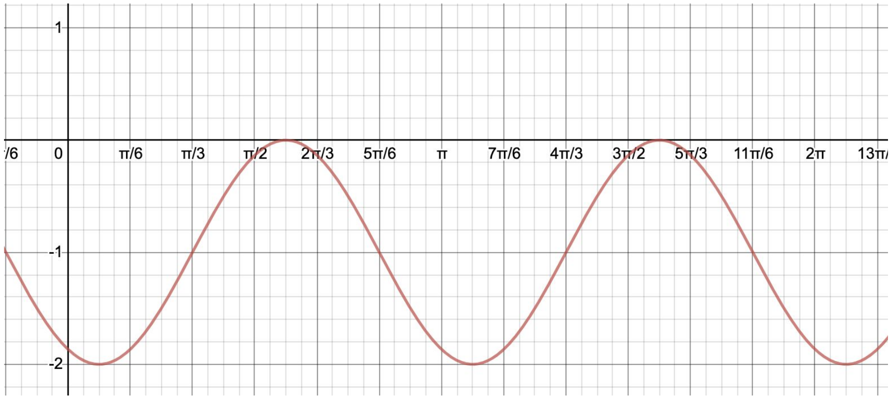
$$(\sin x + 1)(2\sin x - 1) = 0$$

$$\sin x = -1 \mapsto x = \frac{3\pi}{2}$$

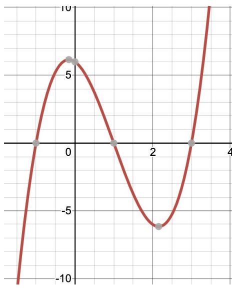
$$\sin x = \frac{1}{2} \mapsto x = \frac{\pi}{6}, \frac{5\pi}{6}$$

6. If $f(x) = \sin(x)$, sketch the graph of

$$g(x) = -f\left(2\left(x + \frac{\pi}{6}\right)\right) - 1$$

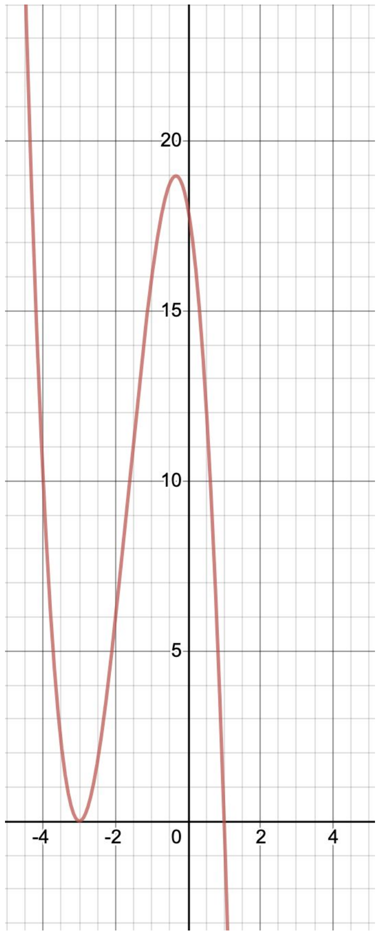


7. Describe key features of the graph of $y=f(x)$ given below. (End behaviour, intervals of increase and decrease, and where $f(x)>0$



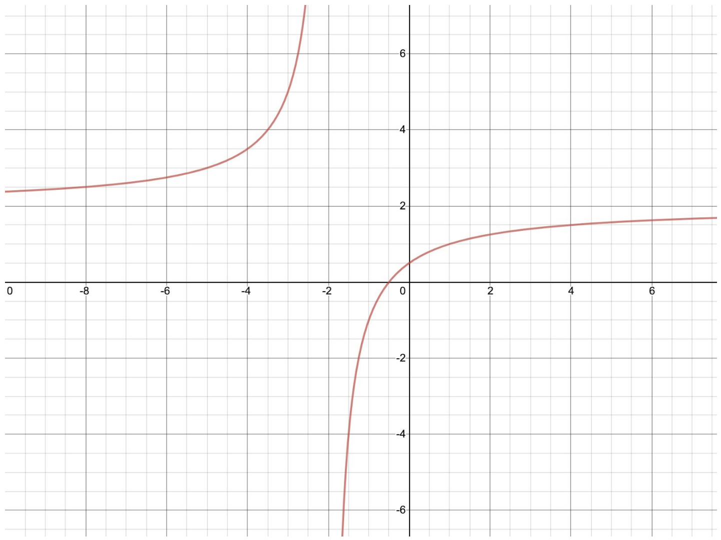
- odd degree
- 3rd degree polynomial
- positive leading coefficient
- x- intercepts at x = -1, 1, 3
- y-intercepts at y = 6
- Begins in quad III and ends in quad I

8. Sketch the graph of $f(x)=-2(x+3)^2(x-1)$



9. Sketch the graph of

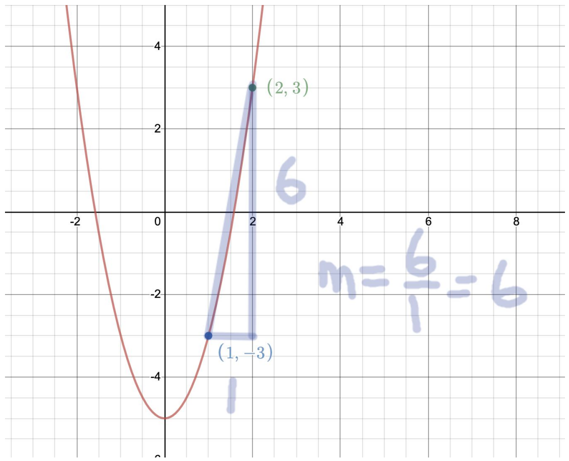
$$f(x) = \frac{2x+1}{x+2}$$



10. Describe how the average rate of change can be used to determine the instantaneous rate of change in any function.

Select two points very close to one another, e.g. *a* and *a + 0.0001*, to approximate the instantaneous rate of change.

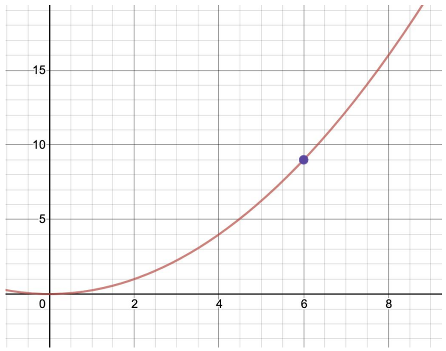
11. Determine the average rate of change graphically and algebraically for the function $f(x) = 2x^2 - 5$ from $x = 1$ to $x = 2$.



Ave rate of change:

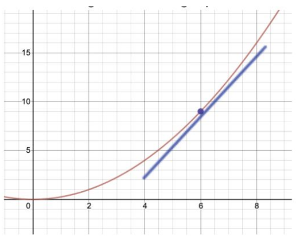
$$\frac{3-(-3)}{2-1} = 6$$

12. Determine an approximation for the instantaneous rate of change using two different methods for the below function, at the point where $x = 6$.



Draw a tangent on the graph and determine the slope of the line which is the instantaneous rate of change

m =



m = $\frac{8}{3}$

Determine the equation of the function → y = 0.25x2

iroc = $\frac{0.25(6)^2 - 0.25(6.001)^2}{6 - 6.001}$ = 3