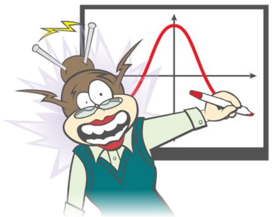
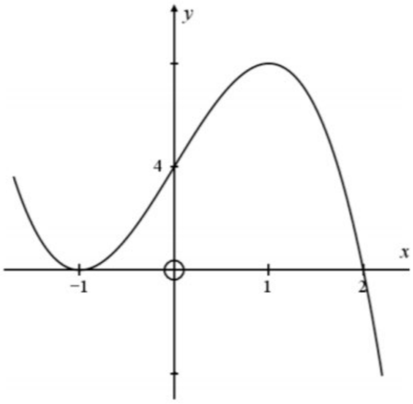
Mathematics Methods



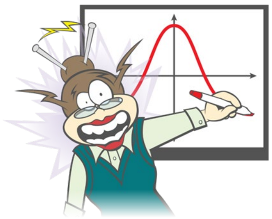
Each of the questions included here can be solved using the TI-Nspire CX CAS.

Question 1

Determine the equation of the cubic function drawn. Give your answer in factored and expanded form.

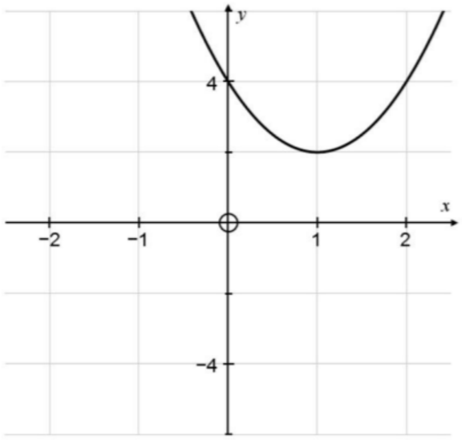


Response:



Question 2

(a) The function $f(x)=2(x-1)^2+2$ is graphed below.
Transform $f(x)$ to $g(x)$ by reflecting $f(x)$ in both the x and y axes.
Sketch the resulting graph on the same axes.



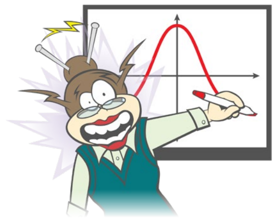
(b) State the equation for $g(x)$.
No working required.

Response:

Question 3

The Richter scale defines the magnitude of an earthquake as $M = log_{10}\left(\frac{I}{s}\right)$, where I is the intensity of the earthquake wave, and s is the intensity of the smallest detectible (or standard) wave.
An earthquake that registered 6.4 in magnitude was followed by another which was 4 times more intense. Determine the magnitude of the second earthquake to one decimal place.

Response:



Question 4

Celsius (T), Fahrenheit (F) and Kelvin (K) are 3 different temperature scales, where:

$$T(K) = K - 273$$

$$F(T) = \frac{9}{5}T + 32$$

a) determine a composite function to convert Kelvin to Fahrenheit.
b) Hence convert 293 Kelvin to Fahrenheit.
c) set up and solve a linear equation to determine the temperature that is the same on both the Celsius and Fahrenheit scales.

Response:

Question 5

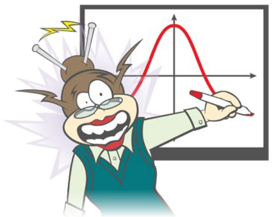
If $y = 3sin\left(\frac{x}{4}\right)$, state the coordinates of all maxima where $x \in [-8\pi, 8\pi]$.

Response:

Question 6

Determine the number of solutions for $sin\theta = -0.7$, where $\theta \in [0, 51\pi]$and provide reasons for your answer.

Response:

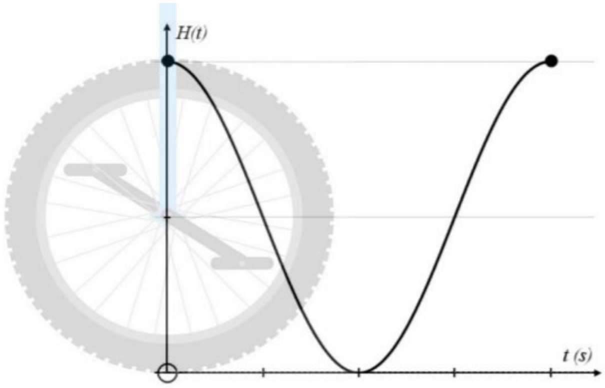


Question 7

A unicycle with a wheel and tyre radius of 25cm is moving at a constant speed of 500 cm/s. A dot on the tyre tread is at its maximum height at the start. The height (in cm) of the dot above the ground is modelled against time in seconds.

(a) Given C=2πr and Period = $\frac{C}{speed}$, show the period for 1 rotation is $\frac{\pi}{10}$ seconds.

(b) Hence, determine a cosine model $H(t) = a\cos(bt) + c$ for the height of the dot above the ground. (The cosine sketch below shows 1 rotation of the wheel.)



(c) Determine the timeframe when $H(t) > \frac{75}{2}$ cm, during the first rotation.

Response:

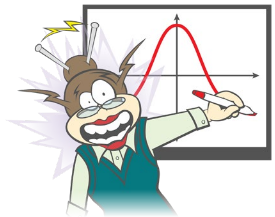
Question 8

The equation $y = x^3 - 9x^2 + 28x - 28$ is a cubic graph that does not have a stationary point.

(a) What is the value of the slope of the tangent at $x = 3$?

(b) Show the equation has no stationary points

Response:



Question 9

The price of a new computer can be modelled by the equation $P = 1000e^{-0.5t} + 200$, where P is the price ($) and t is the time in years.
(a) Calculate the rate of change in price after 5 years.
(b) Calculate the average rate of change over the first 5 years.

Response:

Question 10

Consider the function $f(x) = x^2(x^2 - 2)$. Find and classify the stationary points of the function.

Response: