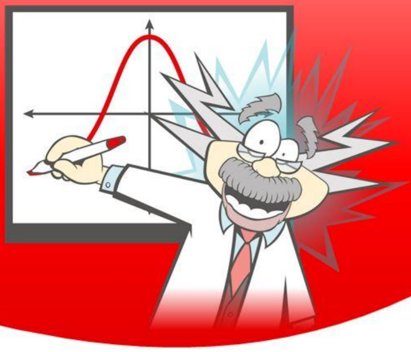
STUDENT REVISION SERIES



Increasing & Decreasing Functions

Each of the questions included here can be solved using either the TI-nspire CX or CX CAS.

Scan the QR code or use the link: http://bit.ly/IncreasingDecreasing

Question: 1.

Determine the region for which $f(x)=x^2-6x+8$ is an increasing function.

Question: 2.

Show that $g(x)=x^3+x$ is an increasing function.

Question: 3.

If $f(x)=x^3+bx^2+15x+4$ is an increasing function, determine the range of values for *b*.

Question: 4.

The number of hours of darkness (night time) in Melbourne can be approximated by the function:

$$f(x)=2.57\sin\left(\frac{2\pi}{365}(x+100)\right)+12.1$$

Where x represents the number of days since the start of the year, determine the interval (approximate dates) for when the 'nights' are getting shorter.

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Answers

Question 1

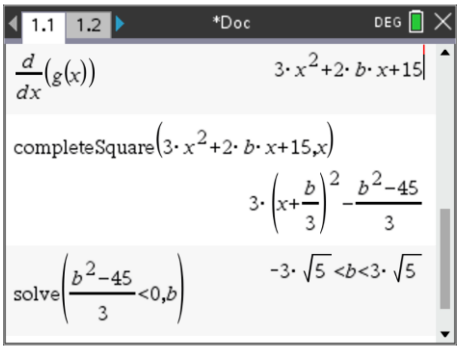
This can be done by completing the square or by calculus. $x^2 - 6x + 8 = (x-3)^2 - 1$. This locates the turning point (3, -1), so the function is increasing over the region [3, ∞)

Question 2

This quickest way to show that $g(x) = x^3 + x$ is to determine the derivative: $g'(x) = 3x^2 + 1$. As per the video, since $x^2 \geq 0$ then if follows that $3x^2 \geq 0$ and therefore $3x^2 + 1 > 0$, so our function $g(x)$ is increasing for all $x \in R$

Question 3

TI-Nspire CX CAS shown



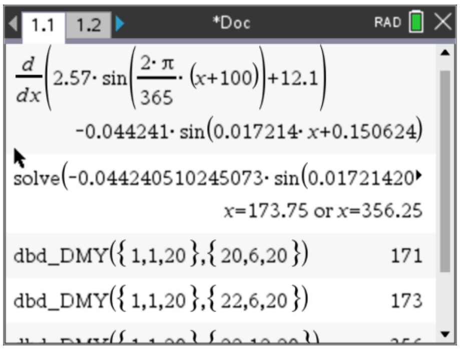
[Line 1]: Again the quickest solution is to use calculus.

[Line 2]: We expect a quadratic result and know from the video that we are looking for a quadratic that is always positive, so completing the square is one option.

[Line 3]: Since $3\left(x+\frac{b}{3}\right)^2 \geq 0$ then we require $-\frac{b^2-45}{3} \geq 0$

Question 4

TI-nspire CX CAS shown



We can use the derivative or our knowledge of trigonometric transformations. [Make sure the calculator is set in radian mode]
When using the solve command, place domain restrictions so that the dates may be obtained within a 12 month period.
The solutions: 173 and 356 represent when the gradient is zero. A quick check of either the graph or by substitution into the derivative reveals that the region we want is: $173 \leq x \leq 356$.
You can use a calendar to determine when these dates occur or the "days between dates" function on the calculator. (DMY = Day,Month,Year)
Whilst this function cannot be used in the Solve command, a rough estimate will help determine the actual dates. An estimate of 20th June reveals that it is day 171, so 22nd June will be 173 days.
Note that the values have been truncated 173.75 became 173. In practical terms the days either side of 22nd June have almost the same number of night time hours.

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