Introduction to calculus, numbers, functions, limits, derivatives, project

Calculus is math of continuous change. It is often used in physics, chemistry, biology, economics, etc.

Your project can be about any topic in calculus, which you like or interested in. You may present your project to the audience.

Bernoulli experiment

Question:

Calculate your life.

Question:

Calculate the best country.

Numbers

Question:

Solve number puzzle for 3 + m8 digits.

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Question:

Find approximation of e number.

Calculate (1+1/T)T.

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Function

Question:

Calculate half-life, which is related to numbers and functions.

For what x is eLx = 0.5?

Question:

Analyse equation of linear function.

Write equation of line perpendicular to y = Tx + L.

Limit

Question:

Illustrate definition of limit using ε – δ language.

. f(x) = Tx + k. For any ε find δ, using ε – δ definition of the limit.

Question:

m2 = 0: When does limit exist?

https://brilliant.org/wiki/when-does-a-limit-exist/

https://en.wikipedia.org/wiki/Limit\_of\_a\_function

m2 = 1: List indeterminate forms.

https://en.wikipedia.org/wiki/Indeterminate\_form

Question:

Give L’Hopital rule.

https://en.wikipedia.org/wiki/L%27H%C3%B4pital%27s\_rule#targetText=In%20mathematics%2C%20more%20specifically%20calculus,be%20easily%20evaluated%20by%20substitution.

m4 = 0: Use L’Hopital rule to prove First Great Limit of Calculus:

m4 = 1:

m4 = 2:

m4 = 3:

**Continuity:**

Question:

Investigate continuity of the function:

m7 = 0: x

m7 = 1:

m7 = 2:

m7 = 3:

m7 = 4:

m7 = 5:

m7 = 6:

Derivative

Question:

What is derivative?

Question:

m2 = 1: Give the properties of derivative: times constant, sum, product, quotient.

Question:

m2 = 0: Prove expression for derivative of x2 using limit.

Question:

Find derivatives of these functions:

m4 = 0: ex

m4 = 1: xp

m4 = 2: cos(x)

m4 = 3:

https://www.derivative-calculator.net/

Question:

Calculate derivative, using Chain Rule for sin(Tx)

Question:

Differential

m4 = 0: d(f+g) =

m4 = 1: d(f-g) =

m4 = 2: d(fg) =

m4 = 3: d(f/g) =

Application of derivative

A function f(x) is increasing if f’(x) > 0

A function f(x) is decreasing if f’(x) < 0

Question:

Increasing or decreasing:

m5 = 0. -6x

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m5 = 1. 9x

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m5 = 2. sin(x)

m5 = 3. cos(x)

m5 = 4. tan(x)

https://www.derivative-calculator.net/

Question:

Find min and MAX.

MAX and min are at points where f’(x) = 0, these are called critical points.

If f’(x) < 0 then f’(x) > 0, then there is minimum.

If f’(x) > 0 then f’(x) < 0, then there is MAXIMUM.

Find the largest area rectangle with perimeter of T meters.

P is Perimeter.

A is Area.

x is width.

y is height.

P = 2x+2y (1)

A = xy (2)

A is minimum when x = 0 or y = 0, in these cases A = xy = 0.

From (1)

(3)

We put y from equation (3) to equation (2)

Derivative is positive at (-∞, )

Derivative is negative at ()

Therefore x = 0.25P is MAXIMUM.

x=0.25P (4)

Putting (4) into (3)

P = T.

From (2)

Rectangle with the largest area is square, if perimeter is the same.

Calculate the largest area right-angled triangle with perimeter of T meters.

a = b

Find maximum volume cylinder for surface area of T meters square. T = 2πRH (5)

For maximum volume R = H.

Maximum volume is

Calculate maximum volume cone for surface area of T meters square. T = πRL

R = H

Calculate maximum area scalene triangle with perimeter of T meters.

All the sides of the triangle must be the same in length to achieve the largest area for the same perimeter.

Question:

Concave or convex:

m4 = 0: x3

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m4 = 1: -x3

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m4 = 2: cos(x)

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m4 = 3: sin(x)

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tan(x)

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Question:

Find inflection point:

m4 = 0: x3

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m4 = 1: -x3

https://calculus12s.weebly.com/uploads/2/5/3/9/25393482/negativesecondderivative.docx

m4 = 2: cos(x)

m4 = 3: sin(x)

Linear regression:

Question:

Find linear least-square approximation for your dataset.

(2, m2), (3, m3), (4, m4)

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Dim x(3), y(3)

m = 3

x(1) = 2

x(2) = 3

x(3) = 4

y(1) = s mod 2

y(2) = s mod 3

y(3) = s mod 4

sx = 0

For j = 1 To m

sx = sx + x(j)

Next j

sy = 0

For j = 1 To m

sy = sy + y(j)

Next j

sxy = 0

For j = 1 To m

sxy = sxy + x(j) \* y(j)

Next j

sx2 = 0

For j = 1 To m

sx2 = sx2 + x(j) ^ 2

Next j

g = (m \* sxy - sx \* sy) / (m \* sx2 - sx ^ 2)

i = (sy - g \* sx) / m

MsgBox g

MsgBox i

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