Notes for calculus UAS final exam:

Study materials:

https://calculus12s.weebly.com/uploads/2/5/3/9/25393482/u3calc2023.docx

https://calculus12s.weebly.com/uploads/2/5/3/9/25393482/u4calc2023.docx

Instructions:

Write all your answers in this Word Document and email the Word Document with your answers to me.

Try to write only text. Try to avoid pictures, videos and other things, which make files big.

Write your name(s)

Write your student number(s)

s is your student number.

k = s mod 10000 = m10000

T = s mod 100 = m100

m = s mod 35 = m35

a = s mod 25 = m25

L = s mod 10 = m10

m9 = s mod 9

e = s mod 8 = m8

m7 = s mod 7

m6 = s mod 6

m5 = s mod 5

m4 = s mod 4.

m3 = s mod 3

m2 = s mod 2

1. Solve the differential equations.

Question:

Solve the wave propagation equation for the velocity v = T.

Solution:

Ordinary linear differential equations with constant coefficients:

(1)

y(x)

a, b, c are real constants.

a is NOT 0.

(2)

(3)

If are real numbers and then the solution is:

If are real numbers and then the solution is:

If are complex conjugate then the solution is:

and are real numbers.

are arbitrary constants.

youtube.com/watch?v=znO6v-8pvXo

Question:

Harmonic oscillation:

Solve this equation:

Ty'' + Ly = 0

L = m10

http://www.wolframalpha.com

Solve this equation:

Ty'' + my' + Ly = 0

m = m35

L = m10

http://www.wolframalpha.com

Question:

Calculate the polar coordinates.

Give equation of T radius circumference in polar coordinates.

R = T

Question:

Give equation of y = Tx in polar coordinates.

s = 22123456

T = s Mod 100

MsgBox Atn(T)

Question:

How many petals are there in the flower R = cos(TA)?

https://www.desmos.com/calculator/ms3eghkkgz

Question:

Plot 3 + m2 petals flower in polar coordinates.

if m2 = 0 then 3 + m2 = 3, then R = cos(3A)

if m2 = 1 then 3 + m2 = 4, then R = cos(2A)

https://www.desmos.com/calculator/ms3eghkkgz

2. Do the vector calculus.

Question:

Find perpendicular vector to (T, m, L).

The solution is vector (a,b,c), such that the dot-product is zero:

aT+ bm+ cL = 0

b=1

c=1

aT +m+L=0

(a,b,c) is perpendicular to (T, m, L).

(1,1) is perpendicular to (T, m, L).

Question:

Find parallel vector to (T, m, L).

(2T, 2m, 2L) is parallel to (T, m, L).

You can use cross-product = 0.

Question:

Calculate triple product of (T, m, L), (a, s, k), (m7, m9, m17).

s = 23123456

T = s mod 100

m = s mod 35

a = s mod 25

m17 = s mod 17

L = s mod 10

m9=s mod 9

m7=s mod 7

tripleproduct=T\*(s\*m17-k\*m9)-m\*(a\*m17-k\*m7)+L\*(a\*m9-s\*m7)

MsgBox tripleproduct

Question:

Find dot-product of tensor and vector

a = m25

e = m8

L = m10

m = m35

q = m17

T = m100

Dim t(2, 2), v(2), r(2)

s = 23123456

a = s Mod 25

e = s Mod 8

L = s Mod 10

m = s Mod 35

q = s Mod 17

tt = s Mod 100

t(1, 1) = L

t(1, 2) = tt

t(2, 1) = a

t(2, 2) = m

v(1) = e

v(2) = q

r(1) = t(1, 1) \* v(1) + t(1, 2) \* v(2)

r(2) = t(2, 1) \* v(1) + t(2, 2) \* v(2)

MsgBox r(1)

MsgBox r(2)

https://calculus17.weebly.com/uploads/7/7/9/0/77906190/tensor\_times\_vector2019nov.txt

**i** = (1,0,0)

**j** = (0,1,0)

**k** = (0,0,1)

Question:

Find these dot-products:

m4 = 0: **ij** = 0

m4 = 1: **jj** = 1

m4 = 2: **kj** = 0

m4 = 3: **ki** = 0

Question:

Find these cross-products.

m4 = 0: **i×j** = **k**

m4 = 1: **j×j** = 0

m4 = 2: **k×j** = -**i**

m4 = 3: **k×i**= **j**

Question:

Expand sin(*T*x) in Legendre polynomial series.

Take only terms 0, 1, 2, 3, 4.

http://www.thermopedia.com/content/918/

https://en.wikipedia.org/wiki/Legendre\_polynomials

**sin(56x)/2 from -1 to 1**

**3\*x\*sin(56\*x)/2 from -1 to 1**

**5\*(3\*x^2-1)\*sin(56\*x)/2 from -1 to 1**

**7(5\*x^3-3x)\*sin(56\*x)/2 from -1 to 1**

**9(35\*x^4-30x^2+3)\*sin(56\*x)/2 from -1 to 1**

https://www.integral-calculator.com/

**youtube.com/watch?v=f86K0QerUug&t=34s**

3. Calculate the complex numbers.

Question:

Calculate: a. i-a b. i-L c. im d. i1/(L+2) e.

f. a – mi + Li – T g. (a – mi)(Ti – L) h. (m – ai)/(Li – T) j. (k – ni)L

p. (a – mi)1/(L+2) q. in u. ik w. iL z. ia

n = s

a = m25.

m = m35.

a.

s = 23123456

m2 = s Mod 2

a = s Mod 25

exponent = a Mod 4

If exponent = 0 Then MsgBox "i^(-a) =1"

If exponent = 1 Then MsgBox "i^(-a) =-i"

If exponent = 2 Then MsgBox "i^(-a) =-1"

If exponent = 3 Then MsgBox "i^(-a) =i"

b.

s = 23123456

m2 = s Mod 2

L = s Mod 10

a = s Mod 25

m = s Mod 35

k = s Mod 10000

n = s

exponent = L Mod 4

If exponent = 0 Then MsgBox "i^(-L) =1"

If exponent = 1 Then MsgBox "i^(-L) =-i"

If exponent = 2 Then MsgBox "i^(-L) =-1"

If exponent = 3 Then MsgBox "i^(-L) =i"

c.

s = 23123456

m2 = s Mod 2

L = s Mod 10

a = s Mod 25

m = s Mod 35

k = s Mod 10000

n = s

exponent = m Mod 4

If exponent = 0 Then MsgBox "i^m =1"

If exponent = 1 Then MsgBox "i^m =i"

If exponent = 2 Then MsgBox "i^m =-1"

If exponent = 3 Then MsgBox "i^m =-i"

d.

s = 23123456

m2 = s Mod 2

L = s Mod 10

a = s Mod 25

m = s Mod 35

T = s Mod 100

k = s Mod 10000

n = s

Pi = 4 \* Atn(1)

x = 0

y = 1

R = Sqr(x ^ 2 + y ^ 2)

alpha = Pi / 2

For c = 0 To L + 1

RealComponent = R ^ 1 / (L + 2) \* Cos((alpha + 2 \* c \* Pi) / (L + 2))

ImaginaryComponent = R ^ 1 / (L + 2) \* Sin((alpha + 2 \* c \* Pi) / (L + 2))

MsgBox "RealComponent"

MsgBox "number"

MsgBox c

MsgBox RealComponent

MsgBox "ImaginaryComponent"

MsgBox "number"

MsgBox c

MsgBox ImaginaryComponent

Next c

e.

s = 23123456

m2 = s Mod 2

L = s Mod 10

a = s Mod 25

m = s Mod 35

T = s Mod 100

k = s Mod 10000

n = s

Pi = 4 \* Atn(1)

x = 1

y = 0

R = Sqr(x ^ 2 + y ^ 2)

alpha = Atn(y / x)

For c = 0 To L + 1

RealComponent = R ^ 1 / (L + 2) \* Cos((alpha + 2 \* c \* Pi) / (L + 2))

ImaginaryComponent = R ^ 1 / (L + 2) \* Sin((alpha + 2 \* c \* Pi) / (L + 2))

MsgBox "RealComponent"

MsgBox "number"

MsgBox c

MsgBox RealComponent

MsgBox "ImaginaryComponent"

MsgBox "number"

MsgBox c

MsgBox ImaginaryComponent

Next c

f.

s = 23123456

m2 = s Mod 2

L = s Mod 10

a = s Mod 25

m = s Mod 35

T = s Mod 100

k = s Mod 10000

n = s

x1 = a

y1 = -m

x2 = -T

y2 = L

RealComponent = x1 + x2

ImaginaryComponent = y1 + y2

MsgBox "RealComponent="

MsgBox RealComponent

MsgBox "ImaginaryComponent="

MsgBox ImaginaryComponent

g.

s = 23123456

m2 = s Mod 2

L = s Mod 10

a = s Mod 25

m = s Mod 35

T = s Mod 100

k = s Mod 10000

n = s

x1 = a

y1 = -m

x2 = -L

y2 = T

RealComponent = x1 \* x2 - y1 \* y2

ImaginaryComponent = x1 \* y2 + x2 \* y1

MsgBox "RealComponent="

MsgBox RealComponent

MsgBox "ImaginaryComponent="

MsgBox ImaginaryComponent

h.

s = 23123456

m2 = s Mod 2

L = s Mod 10

a = s Mod 25

m = s Mod 35

T = s Mod 100

k = s Mod 10000

n = s

x1 = m

y1 = -a

x2 = -T

y2 = L

RealComponent = (x1 \* x2 + y1 \* y2)/( x2 ^ 2 + y2 ^ 2)

ImaginaryComponent = (x2\*y1-x1\*y2)/(x2 ^ 2 + y2 ^ 2)

MsgBox "RealComponent="

MsgBox RealComponent

MsgBox "ImaginaryComponent="

MsgBox ImaginaryComponent

j.

s = 23123456

m2 = s Mod 2

L = s Mod 10

a = s Mod 25

m = s Mod 35

T = s Mod 100

k = s Mod 10000

n = s

x = k

y = -n

R = Sqr(x ^ 2 + y ^ 2)

alpha = Atn(y / x)

RealComponent = R ^ L \* Cos(L \* alpha)

ImaginaryComponent = R ^ L \* Sin(L \* alpha)

MsgBox "RealComponent="

MsgBox RealComponent

MsgBox "ImaginaryComponent="

MsgBox ImaginaryComponent

p.

s = 23123456

m2 = s Mod 2

L = s Mod 10

a = s Mod 25

m = s Mod 35

T = s Mod 100

k = s Mod 10000

n = s

Pi = 4 \* Atn(1)

x = a

y = -m

R = Sqr(x ^ 2 + y ^ 2)

alpha = Atn(y / x)

For c = 0 To L + 1

RealComponent = R ^ 1 / (L + 2) \* Cos((alpha + 2 \* c \* Pi) / (L + 2))

ImaginaryComponent = R ^ 1 / (L + 2) \* Sin((alpha + 2 \* c \* Pi) / (L + 2))

MsgBox "RealComponent"

MsgBox "number"

MsgBox c

MsgBox RealComponent

MsgBox "ImaginaryComponent"

MsgBox "number"

MsgBox c

MsgBox ImaginaryComponent

Next c

q.

s = 23123456

m2 = s Mod 2

L = s Mod 10

a = s Mod 25

k = s Mod 10000

n = s

exponent = n Mod 4

If exponent = 0 Then MsgBox "i^n =1"

If exponent = 1 Then MsgBox "i^n =i"

If exponent = 2 Then MsgBox "i^n =-1"

If exponent = 3 Then MsgBox "i^n =-i"

u.

s = 23123456

m2 = s Mod 2

L = s Mod 10

a = s Mod 25

k = s Mod 10000

exponent = k Mod 4

If exponent = 0 Then MsgBox "i^k =1"

If exponent = 1 Then MsgBox "i^k =i"

If exponent = 2 Then MsgBox "i^k =-1"

If exponent = 3 Then MsgBox "i^k =-i"

w.

s = 23123456

m2 = s Mod 2

L = s Mod 10

a = s Mod 25

exponent = L Mod 4

If exponent = 0 Then MsgBox "i^L =1"

If exponent = 1 Then MsgBox "i^L =i"

If exponent = 2 Then MsgBox "i^L =-1"

If exponent = 3 Then MsgBox "i^L =-i"

z.

s = 23123456

m2 = s Mod 2

a = s Mod 25

exponent = a Mod 4

If exponent = 0 Then MsgBox "i^a =1"

If exponent = 1 Then MsgBox "i^a =i"

If exponent = 2 Then MsgBox "i^a =-1"

If exponent = 3 Then MsgBox "i^a =-i"

Complex numbers:

Question:

Find

a.

b.

c.

d. (T+im)(a-Li)

e. (T+im)+(a-Li)

f. (T+im)-(a-Li)

L = m10.

a = m25.

m = m35.

T = m100.

a.

s = 23123456

m2 = s Mod 2

L = s Mod 10

a = s Mod 25

m = s Mod 35

T = s Mod 100

k = s Mod 10000

n = s

m3 = s mod 3

power = 3+m3

x = m

y = -T

R = Sqr(x ^ 2 + y ^ 2)

alpha = Atn(y / x)

RealComponent = R ^ power \* Cos(power \* alpha)

ImaginaryComponent = R ^ power \* Sin(power \* alpha)

MsgBox "RealComponent="

MsgBox RealComponent

MsgBox "ImaginaryComponent="

MsgBox ImaginaryComponent

b.

s = 23123456

m2 = s Mod 2

L = s Mod 10

a = s Mod 25

m = s Mod 35

T = s Mod 100

k = s Mod 10000

n = s

x1 = T

y1 = m

x2 = a

y2 = -L

RealComponent = (x1 \* x2 + y1 \* y2)/( x2 ^ 2 + y2 ^ 2)

ImaginaryComponent = (x2\*y1-x1\*y2)/(x2 ^ 2 + y2 ^ 2)

MsgBox "RealComponent="

MsgBox RealComponent

MsgBox "ImaginaryComponent="

MsgBox ImaginaryComponent

c.

s = 23123456

m2 = s Mod 2

m3=s mod 3

L = s Mod 10

a = s Mod 25

m = s Mod 35

T = s Mod 100

k = s Mod 10000

n = s

Pi = 4 \* Atn(1)

RootPower = m3+3

x = T

y = m

R = Sqr(x ^ 2 + y ^ 2)

alpha = Atn(y / x)

For c = 0 To RootPower-1

RealComponent = R ^ 1 / (RootPower) \* Cos((alpha + 2 \* c \* Pi) / (RootPower))

ImaginaryComponent = R ^ 1 / (RootPower) \* Sin((alpha + 2 \* c \* Pi) / (RootPower))

MsgBox "RealComponent"

MsgBox "number"

MsgBox c

MsgBox RealComponent

MsgBox "ImaginaryComponent"

MsgBox "number"

MsgBox c

MsgBox ImaginaryComponent

Next c

d.

s = 23123456

m2 = s Mod 2

L = s Mod 10

a = s Mod 25

m = s Mod 35

T = s Mod 100

k = s Mod 10000

n = s

x1 = T

y1 = m

x2 = a

y2 = -L

RealComponent = x1 \* x2 - y1 \* y2

ImaginaryComponent = x1 \* y2 + x2 \* y1

MsgBox "RealComponent="

MsgBox RealComponent

MsgBox "ImaginaryComponent="

MsgBox ImaginaryComponent

e.

s = 23123456

m2 = s Mod 2

L = s Mod 10

a = s Mod 25

m = s Mod 35

T = s Mod 100

k = s Mod 10000

n = s

x1 = T

y1 = m

x2 = a

y2 = -L

RealComponent = x1 + x2

ImaginaryComponent = y1 + y2

MsgBox "RealComponent="

MsgBox RealComponent

MsgBox "ImaginaryComponent="

MsgBox ImaginaryComponent

f.

s = 23123456

m2 = s Mod 2

L = s Mod 10

a = s Mod 25

m = s Mod 35

T = s Mod 100

k = s Mod 10000

n = s

x1 = T

y1 = m

x2 = a

y2 = -L

RealComponent = x1 - x2

ImaginaryComponent = y1 - y2

MsgBox "RealComponent="

MsgBox RealComponent

MsgBox "ImaginaryComponent="

MsgBox ImaginaryComponent

Question:

Investigate

Maximum for x = T.

desmos.com/calculator

4. Prove .

z(0) = 1

C = 1

youtube.com/watch?v=4hxpA-SPiRQ

Question:

Explain the laws of the calculus.

Explain the formulas, equations, concepts, laws, theories of the calculus.