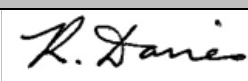


EXAMINATION INTERNAL VERIFICATION FORM (2017-2018)

MODULE :	PSDE5008 Further Engineering Mathematics	LEVEL:	5
PROGRAMME :	HNC Electrical and Electronic Engineering	TERM OF EXAM: (SPRING OR SUMMER)	n/a
LEARNING OUTCOME(S) BEING ASSESSED:	MILO1, MILO 2	EXAM PAPER:	Main Class Test 3
		EXAMINATION AUTHOR :	A. Thomas

VERSION:	DATE SUBMITTED FOR VERIFICATION:	INTERNAL VERIFIER COMMENTS (Approval or detail of amendments required):	DATE:
1.	17-04-18	Conforms to the assessment pattern and tests the learning outcomes appropriately.	18-04-18
2.			

INTERNAL VERIFIER PLEASE TICK TO INDICATE THAT THE EXAMINATION:	
☒	Conforms to the assessment pattern described in the module syllabus
☒	Tests the module learning outcome(s) appropriately

SIGNATURES OF FINAL APPROVAL:	SIGNATURE	DATE
INTERNAL VERIFIER: I confirm that this version of the exam paper is ready to be sent to the external examiner		18-04-18
EXAM AUTHOR: I confirm that internal verifier and external examiner approval have been received and that this version of the exam paper is ready for printing.		

HNC Electrical and Electronic Engineering
PSDE5008 Further Engineering Mathematics
Level 5, Year 2

Class Test 3 (2017-18)

This is an open book test, worth **10%** of the module mark and addresses Module Intended Learning Outcome2.

Date of test =

Time allowed = 1 hour

Instructions to candidates:

- **Use Matlab to solve the following questions**
- **Copy and paste your work into a word file, which should include your name in the header**
- **Print out your word file to allow you to include your hand written solutions**
- **Answer all questions**

1. Solve the following differential equations and obtain plots in each case:

Note: For plot, take t axis from 0.1 to 5

In each case write out, by hand, the mathematical equivalent of the printout solution.

- a) $5ty' = 2t + 4y, y(1) = 2$
b) $3y' - 6ty = t^2, y(2) = 3$
c) $2y'' - 2y' - 7y = 0, y(3) = 4, y'(2) = 3$

(60 Marks)

2. Determine the Laplace Transforms of the following:

In each case write out, *after simplifying your answer*, by hand, the mathematical equivalent of the printout solution.

- a) $f(x) = -2x^2 \cos^2(3x) \quad (x > 0)$
b) $f(x) = 3x^3 \sin^2(2x) \quad (x > 0)$

(30 Marks)

3. Determine the Fourier Transform of the following:

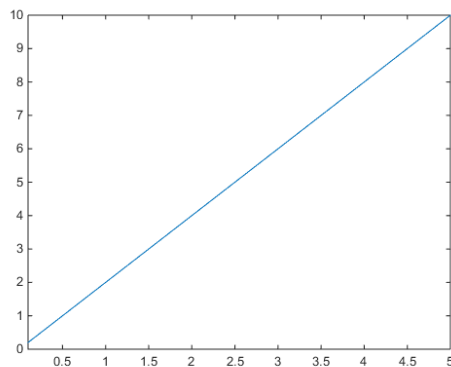
$$f(x) = 3e^{-2x^2}$$

and write out, by hand, the mathematical equivalent of the printout solution.

(10 Marks)

1a)`>> dsolve('5*t*Dy=2*t+4*y','y(1)=2')`**(4)**

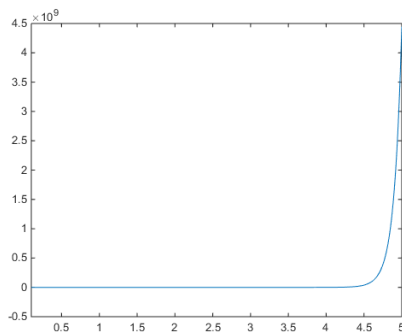
ans =

 $2*t$ **(4)**`>> fplot('2*t',[0.1,5])`**(4)****(4)**

Hand written

(4)**1b)**`>> dsolve('3*Dy-6*t*y=t^2','y(2)=3')`**(4)**

ans =

$$\exp(t^2) * ((10 * \exp(-4))/3 + (\pi^{1/2} * \operatorname{erfi}(2*i)*i)/12) - \exp(t^2) * ((\pi^{1/2} * \operatorname{erfi}(t*i)*i)/12 + (t * \exp(-t^2))/6)$$
(4)
`>> fplot('exp(t^2)*((10*exp(-4))/3 + (pi^(1/2)*erfi(2*i)*i)/12) - exp(t^2)*((pi^(1/2)*erfi(t*i)*i)/12 + (t*exp(-t^2))/6)',[0.1,5])`
(4)**(4)**

Hand written

(4)

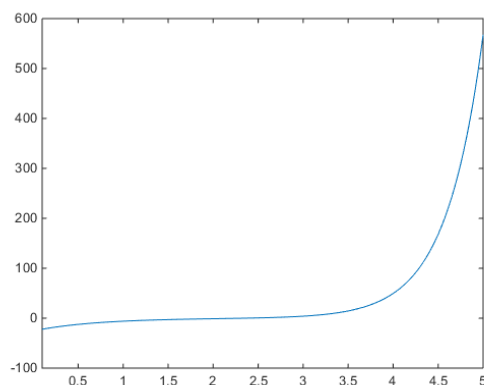
1c)

```
>> dsolve('2*D2y-2*Dy-7*y=0','y(3)=4,Dy(2)=3') (4)
```

ans =

```
(2*exp(t*(15^(1/2)/2 + 1/2))*(3*exp(3/2 - (3*15^(1/2))/2) - 2*exp(1 - 15^(1/2)) + 2*15^(1/2)*exp(1 - 15^(1/2))))/(exp(15^(1/2) + 1)*exp(3/2 - (3*15^(1/2))/2) - exp(1 - 15^(1/2))*exp((3*15^(1/2))/2 + 3/2) + 15^(1/2)*exp(15^(1/2) + 1)*exp(3/2 - (3*15^(1/2))/2) + 15^(1/2)*exp(1 - 15^(1/2))*exp((3*15^(1/2))/2 + 3/2)) + (2*exp(-t*(15^(1/2)/2 - 1/2))*(2*exp(15^(1/2) + 1) - 3*exp((3*15^(1/2))/2 + 3/2) + 2*15^(1/2)*exp(15^(1/2) + 1)))/(exp(15^(1/2) + 1)*exp(3/2 - (3*15^(1/2))/2) - exp(1 - 15^(1/2))*exp((3*15^(1/2))/2 + 3/2) + 15^(1/2)*exp(15^(1/2) + 1)*exp(3/2 - (3*15^(1/2))/2) + 15^(1/2)*exp(1 - 15^(1/2))*exp((3*15^(1/2))/2 + 3/2)) (4)
```

```
>> fplot('(2*exp(t*(15^(1/2)/2 + 1/2))*(3*exp(3/2 - (3*15^(1/2))/2) - 2*exp(1 - 15^(1/2)) + 2*15^(1/2)*exp(1 - 15^(1/2))))/(exp(15^(1/2) + 1)*exp(3/2 - (3*15^(1/2))/2) - exp(1 - 15^(1/2))*exp((3*15^(1/2))/2 + 3/2) + 15^(1/2)*exp(15^(1/2) + 1)*exp(3/2 - (3*15^(1/2))/2) + 15^(1/2)*exp(1 - 15^(1/2))*exp((3*15^(1/2))/2 + 3/2)) + (2*exp(-t*(15^(1/2)/2 - 1/2))*(2*exp(15^(1/2) + 1) - 3*exp((3*15^(1/2))/2 + 3/2) + 2*15^(1/2)*exp(15^(1/2) + 1)))/(exp(15^(1/2) + 1)*exp(3/2 - (3*15^(1/2))/2) - exp(1 - 15^(1/2))*exp((3*15^(1/2))/2 + 3/2) + 15^(1/2)*exp(15^(1/2) + 1)*exp(3/2 - (3*15^(1/2))/2) + 15^(1/2)*exp(1 - 15^(1/2))*exp((3*15^(1/2))/2 + 3/2))', [0,1,5]) (4)
```



(4)

Hand written

(4)

2a)

```
>> x=sym('x') (2)
```

x =

x

```
>> f=-2*x^2*(cos(3*x))^2 (2)
```

f =

$$-2*x^2*\cos(3*x)^2$$

>> laplace(f) (2)

ans =

$$(6*s)/(s^2 + 36)^2 - (8*s^3)/(s^2 + 36)^3 - 2/s^3 \quad (2)$$

simplify(ans) (2)

$$-(4*(s^6 + 1944*s^2 + 23328))/(s^3*(s^2 + 36)^3) \quad (2)$$

Hand written (3)

2b)

>> x=sym('x') (2)

x =

x

>> f=3*x^3*(sin(2*x))^2 (2)

f =

$$3*x^3*\sin(2*x)^2$$

>> laplace(f) (2)

ans =

$$(72*s^2)/(s^2 + 16)^3 - 9/(s^2 + 16)^2 - (72*s^4)/(s^2 + 16)^4 + 9/s^4 \quad (2)$$

simplify(ans) (2)

$$(288*(5*s^6 + 40*s^4 + 512*s^2 + 2048))/(s^4*(s^2 + 16)^4) \quad (2)$$

Hand written (3)

3

>> x=sym('x') (2)

x =

x

>> f=3*exp(-2*x^2) (2)

f =

$$3*\exp(-2*x^2)$$

```
>> fourier(f)
```

(2)

```
ans =
```

```
(3*2^(1/2)*pi^(1/2)*exp(-w^2/8))/2
```

Hand written

(4)