



INTERNAL ASSESSMENT APPROVAL FORM (INCLUDING COLLABORATIVE PROVISION)

This form is used to ensure that assessment specifications have been through an internal review process prior to external examination/approval and release to students. It should be completed for each assessment for a particular module. The assessment tasks, criteria and marking scheme should accompany this form.

PARTNER (and taught location if relevant):	Coleg Sirgar				
EXTERNAL EXAMINER NAME:	To be advised				
ASSESSMENT AUTHOR:	A J Thomas				
MODULE TITLE:	Mechanical Engineering Mathematics				
MODULE CODE:	SGDM4005		MODULE LEVEL:	4	
COMPONENT NO. (e.g. 1 of 2):	1 of 2		COMPONENT WEIGHTING (e.g. 50% of the module):	50	
ASSESSMENT PERIOD	☒ Semester 1	☐ Semester 1 Re-sit	☐ Semester 2	☒ Semester 2 Re-sit	Other, please state
TYPE OF ASSESSMENT:	☒ Coursework		☒ Examination		☐ Practical
LANGUAGE OF ASSESSMENT:	English		TRANSLATION REQUIRED (Y/N):	N	
FOR EXAMINATIONS ONLY. SPECIFY BELOW ANY ADDITIONAL MATERIAL(S) TO BE USED IN THE EXAMINATION					
This box will expand as you type					

INTERNAL MODERATOR PLEASE TICK TO INDICATE THAT THE ASSESSMENT INCLUDES:		Please ✓		Comments
		YES	NO	
1	Tasks that are specified clearly, accurately and comprehensibly, with appropriate use of language and neat presentation	Y		
2	Tasks which enable the module learning outcomes to be demonstrated (as per the module syllabus)	Y		
3	Tasks which conform to the assessment described in the module syllabus	Y		
4	Tasks which are written at the appropriate level of the Framework for Higher Education Qualifications (see http://www.qaa.ac.uk/docs/qaa/quality-code/qualifications-frameworks.pdf?sfvrsn=170af781_14).	Y		
5	Clear criteria for assessment and guidance about how marking/grading will be applied	Y		
6	Guidance about expected evidence for submission, e.g. essay or report, word count, bibliography and references			n/a
7	Reference to good academic conduct, for example referencing, plagiarism and Turnitin			n/a
8	Actions to complete 			
SIGNATURE OF APPROVAL:		SIGNATURE		DATE
INTERNAL MODERATOR: I confirm that this version of the assessment specification is ready				22-10-19

to be sent to the Partnership Team Leader		
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ONLY TO BE COMPLETED IF THE ASSESSMENT IS LINKED TO A COLLABORATIVE PARTNER

PARTNERSHIP TEAM LEADER PLEASE TICK TO INDICATE THAT THE ASSESSMENT INCLUDES:		Please ✓		Comments
		YES	NO	
1	Tasks that are specified clearly, accurately and comprehensibly, with appropriate use of language and neat presentation			
2	Tasks which enable the module learning outcomes to be demonstrated (as per the module syllabus)			
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SIGNATURE OF APPROVAL:		SIGNATURE		DATE
PTL: I confirm that this version of the assessment specification is ready to be sent to the External Examiner				

UWTSD PROVISION: please submit the completed document to the appropriate Programme Director.

COLLABORATIVE PROVISION: please submit the completed document (or make available electronically) to the Partnership Team Leader. This must be in accord with specific arrangements for sharing electronic documents (e.g. via SharePoint or similar).

The assessment tasks, criteria and marking scheme should accompany this form

THIS DOCUMENT IS ALSO AVAILABLE IN WELSH



Prifysgol Cymru
Y Drindod Dewi Sant
University of Wales
Trinity Saint David

LOCATION: Coleg Sir Gar

LEVEL 4

EXAMINATION PERIOD
JANUARY 2020

LLEOLIAD: Coleg Sir Gar

LEVEL 4

CYFNOD ARHOLIADAU
IONAWR 2020

MODULE CODE: SGDM4005
Mechanical Engineering Mathematics 1

Exam 1

TIME: 2 HOURS

ANSWER ALL QUESTIONS

Equipment or materials required – Calculators are permitted.

Adnoddau neu ddefnyddiau sydd eu hangen - Coniateir cyfrifianellau.

1 Solve the following equations:

(i) $3(2x - 3) - 4(3x - 2) = 21$

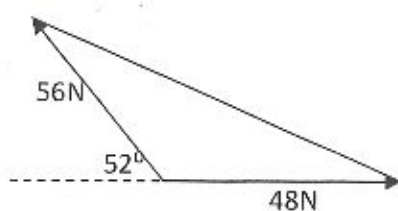
(ii) $3x + 4y = -2.5$
 $6x + 2y = 1$

(iii) $3x^2 - 5x - 6 = 0$ correct to 2 d.p.

(iv) $10^{3x-5} = 1640.$

[20]

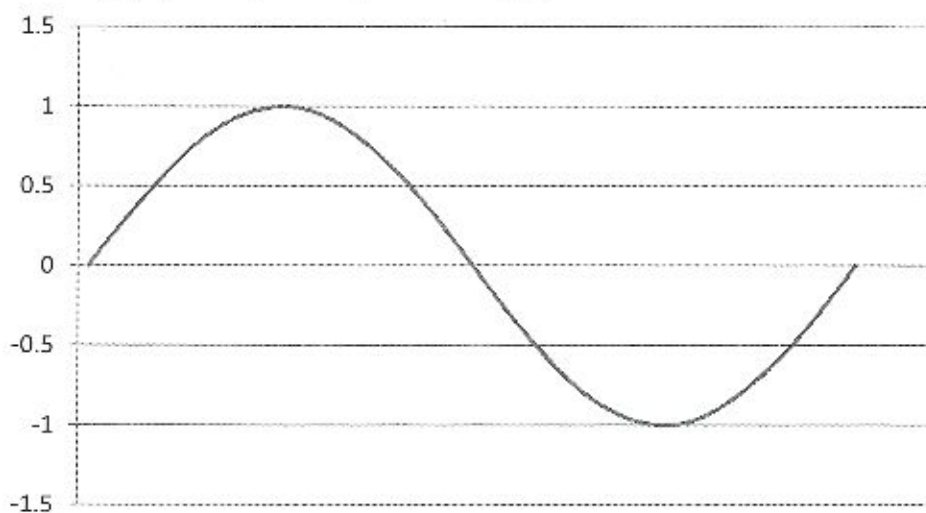
2 Calculate the resultant of the two forces shown, and the angle it makes with the horizontal



[15]

3 (i) Find all angles x between 0° and 360° that satisfy the equation $\sin 2x = 0.5$.

(ii) The graph of $y = \sin x$ is shown below. Sketch, on this graph, the graphs of
(a) $y = \sin(x + 45^\circ)$ and (b) $y = 1.5 \sin 3x$



[15]

- 4 The average number of goals scored in a hockey match is 1.9. Use the **Poisson distribution** to find the probability that in any randomly chosen match
- (i) 3 goals are scored (ii) more than 1 goals are scored.

[10]

- 5 When a gun is fired at a target there is a probability of $\frac{3}{5}$ of hitting the bull. Use the **binomial distribution** to find the probability of hitting
- (i) exactly 1 bull when 3 shots are fired
- (ii) at least 3 bulls when 4 shots are fired.

[10]

- 6 A sample of 80 components was tested to failure to find its life time. The results, to the nearest 100 hours, were

Life (hundreds of hours) (x)	4	5	6	7	8
Frequency (f)	8	20	23	18	11

Calculate the mean and standard deviation of this data, both to 2 d.p.
Show your working for full marks.

[15]

- 7 Apply the method of least squares to fit a straight line relationship for the following points

x	6	3	9	15	2	14	21	13
y	1.3	0.7	2.0	3.7	0.5	2.9	4.5	2.7

Determine the regression line correct to 3 significant figures

[15]

Exam 1 (2019-20) Solutions/Mark Scheme

			Qu total
(i)	$3(2x-3) - 4(3x-2) = 21$ $6x - 9 - 12x + 8 = 21$ $-6x - 1 = 21$ $-6x = 21 + 1$ $x = \frac{22}{-6} = -3.67$	5	
(ii)	$3x + 4y = -2.5$ $6x + 2y = 1 \quad \times 2$ $12x + 4y = 2$ $9x = 4.5$ $x = \frac{4.5}{9} = 0.5$ $6(0.5) + 2y = 1$ $2y = 1 - 3$ $y = \frac{-2}{2} = -1$	5	
(iii)	$3x^2 - 5x - 6 = 0$ $x = \frac{-(-5) \pm \sqrt{(-5)^2 - 4(3)(-6)}}{2(3)}$ $= \frac{5 \pm \sqrt{97}}{6}$ $= 2.47 \text{ or } -0.81$	5	
(iv)	$10^{3x-5} = 1640$ $3x-5 = \log 1640$ $3x = \log 1640 + 5$ $x = \frac{\log 1640 + 5}{3}$ $x = 2.74$	5	20

Exam 1 (2019-20) Solutions/Mark Scheme

				Qu total
2.	$R^2 = 48^2 + 56^2 - (2 \times 48 \times 56 \cos 128)$ $R^2 = 8749.796$ $R = 93.54 \text{ N}$ $\frac{\sin \theta}{56} = \frac{\sin 128}{93.54}$ $\sin \theta = \frac{\sin 128 \times 56}{93.54}$ $\theta = 28.15^\circ$		8	
30)	$\sin 2x = 0.5$ $2x = \sin^{-1} 0.5 = 30^\circ$ Also $2x = 180 - 30 = 150^\circ$ and $2x = 30 + 360 = 390^\circ$ and $2x = 150 + 360 = 510^\circ$ $\therefore x = \frac{30}{2}, \frac{150}{2}, \frac{390}{2}, \frac{510}{2}$ $x = 15^\circ, 75^\circ, 195^\circ, 255^\circ$ 		8	15
(ii) Sketch.			3	11
4.	$P(x=r) = \frac{e^{-1.9} 1.9^r}{r!} = \frac{e^{-1.9} 1.9^r}{r!}$		2, 2	4
(i)	$P(x=3) = \frac{e^{-1.9} 1.9^3}{3!}$ $= 0.171$		4	
(ii)	More than 1 $= 1 - P(0) - P(1)$ $P(0) = \frac{e^{-1.9} 1.9^0}{0!} = 0.1496$ $P(1) = \frac{e^{-1.9} 1.9^1}{1!} = 0.2842$ $\therefore P(>1) = 1 - 0.1496 - 0.2842$ $= 0.5662$		6	10

Exam 1 (2019-20) Solutions/Mark Scheme

				Qu total																																								
5	if $P = \text{hitting the bull} = 0.6$ $q = 1 - 0.6 = 0.4$ (i) $n = 3, P(1 \text{ bull}) = \binom{3}{1} p^1 q^{3-1}$ $= \binom{3}{1} 0.6 \times 0.4^2$ $= 0.288$ (ii) at least 3 = 3 or 4 $P(3) = \binom{4}{3} (0.6)^3 (0.4)$ $= 0.3456$ $P(4) = \binom{4}{4} (0.6)^4 (0.4)^0$ $= 0.1296$ $\therefore P(3 \text{ or } 4) = 0.3456 + 0.1296$ $= 0.4752$	4																																										
6	<table border="1"> <thead> <tr> <th>x</th> <th>f</th> <th>fx</th> <th>$f(x - \bar{x})^2$</th> </tr> </thead> <tbody> <tr><td>4</td><td>8</td><td>32</td><td>33.62</td></tr> <tr><td>5</td><td>20</td><td>100</td><td>22.05</td></tr> <tr><td>6</td><td>23</td><td>138</td><td>0.038</td></tr> <tr><td>7</td><td>18</td><td>126</td><td>16.245</td></tr> <tr><td>8</td><td>11</td><td>88</td><td>41.8275</td></tr> <tr><td></td><td>80</td><td>484</td><td>113.8</td></tr> </tbody> </table> $\bar{x} = \frac{484}{80} = 6.05$ $\sigma = \sqrt{\frac{113.8}{80}} = 1.19$	x	f	fx	$f(x - \bar{x})^2$	4	8	32	33.62	5	20	100	22.05	6	23	138	0.038	7	18	126	16.245	8	11	88	41.8275		80	484	113.8	6	10													
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Prifysgol Cymru
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LOCATION: Coleg Sir Gar

LEVEL 4

EXAMINATION PERIOD
AUGUST 2020

LLEOLIAD: Coleg Sir Gar

LEVEL 4

CYFNOD ARHOLIADAU
AWST 2020

MODULE CODE: SGDM4005
Mechanical Engineering Mathematics 1

Exam 1

TIME: 2 HOURS

ANSWER ALL QUESTIONS

Equipment or materials required – Calculators are permitted.

Adnoddau neu ddefnyddiau sydd eu hangen - Caniateir cyfrifiannellau.

1 Solve the following equations:

(i) $2(4x - 2) - 3(2 - 3x) = 41$

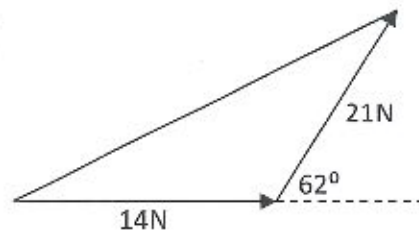
(ii) $2x^2 - 2x - 12 = 0$

(iii) $4x + 3y = -1$
 $6x - 2y = 5$

(iv) $10^{4x-2} = 1675$

[20]

2 Calculate the resultant of the two forces shown, and the angle it makes with the horizontal

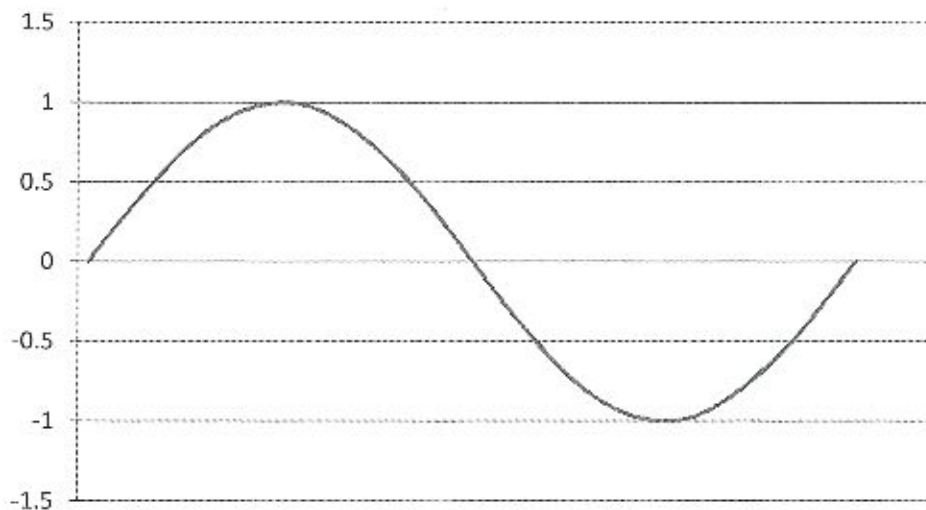


[15]

3 (i) Find all angles x between 0° and 360° that satisfy the equation
 $\cos 2x = 0.5$

(ii) The graph of $y = \sin x$ is shown below. Sketch, on this graph, the graphs of

(a) $y = \sin(x - 45^\circ)$ and (b) $y = 1.5 \sin 2x$



[15]

- 4 A sample of 100 components was tested to failure to find its life time.
The results, to the nearest 100 hours, were

Life (hundreds of hours) (x)	7	8	9	10	11
Frequency (f)	10	23	26	27	14

Calculate, to 3 significant figures, the mean and standard deviation of this data.
Show your working for full marks.

[15]

- 5 When a gun is fired at a target there is a probability of 0.35 of hitting the bull. Use the **binomial distribution** to find the probability of hitting
- (i) exactly 1 bull when 3 shots are fired
 - (ii) at least 3 bulls when 4 shots are fired.

[10]

- 6 The average number of goals scored in a hockey match is 1.75. Use the **Poisson distribution** to find the probability that in any randomly chosen match
- (i) 3 goals are scored
 - (ii) more than 1 goals are scored.

[10]

- 7 Apply the method of least squares to fit a straight line relationship for the following points

x	2	4	6	8	10	12	14
y	5	11	15	19	24	28	33

Determine the regression line correct to 4 significant figures.

[15]

Exam 1 (2019-20) Solutions/Mark Scheme

				Qu total
(i)	$2(4x-2)-3(2-3x)=41$ $8x-4-6+9x=41$ $17x-10=41$ $x=\frac{51}{17}$ $x=3$			
(ii)	$2x^2-2x-12=0$ $x^2-x-6=0$ $(x+2)(x-3)=0$ $x=-2 \text{ or } x=3$			
(iii)	$4x+3y=-1 \quad \times 2$ $6x-2y=5 \quad \times 3$ $8x+6y=-2$ $18x-6y=15$ $26x=13$ $x=\frac{13}{26}=0.5$ $4(0.5)+3y=-1$ $3y=-3$ $y=-1$			
(iv)	$10^{4x-2}=1675$ $4x-2=\log 1675$ $x=\frac{\log 1675+2}{4}$ $x=1.306$			
2	$R^2=14^2+21^2-(2 \times 14 \times 21 \times \cos 118^\circ)$ $R^2=913.05$ $R=30.22$ $\frac{\sin \theta}{21}=\frac{\sin 118^\circ}{30.22}$ $\sin \theta=\frac{\sin 118^\circ \times 21}{30.22}$ $\theta=37.85^\circ$			

Exam 1 (2019-20) Solutions/Mark Scheme

Qu
total

3(i) $\cos 2x = 0.5$

$$2x = \cos^{-1}(0.5) = 60^\circ$$

also $2x = 360 - 60 = 300^\circ$

and $2x = 360 + 60 = 420^\circ$

and $2x = 300 + 360 = 660^\circ$

$$\therefore x = \frac{60}{2}, \frac{300}{2}, \frac{420}{2}, \frac{660}{2}$$

$$= 30^\circ, 150^\circ, 210^\circ, 330^\circ$$

(ii) Sketch

4

x	f	xf	$(x - \bar{x})^2 f$
7	10	70	44.944
8	23	184	28.8512
9	26	234	0.3744
10	27	270	20.9088
11	14	154	49.4816
	100	912	144.56

$$\bar{x} = \frac{912}{100} = 9.12$$

$$\sigma = \sqrt{\frac{144.56}{100}} = 1.20$$

5

$$p = 0.35 \therefore q = 1 - 0.35 = 0.65$$

(i)

$$n = 3, P(1) = \binom{3}{1} p^1 q^2$$

$$= \binom{3}{1} (0.35)^1 (0.65)^2$$

$$= 0.4436$$

(ii)

$n = 3$, either 3 or 4

$$P(3) = \binom{4}{3} (0.35)^3 (0.65)$$

$$= 0.1115$$

$$P(4) = \binom{4}{4} (0.35)^4 (0.65)^0$$

$$= 0.0150$$

$$\therefore P(3 \text{ or } 4) = 0.1115 + 0.0150$$

$$= 0.1265$$

Exam 1 (2019-20) Solutions/Mark Scheme

				Qu total																																				
6.	$P(x=r) = \frac{e^{-1.75} \times 1.75^r}{r!}$																																							
(i)	$P(x=3) = \frac{e^{-1.75} \times 1.75^3}{3!}$ $= 0.1552$																																							
(ii)	More than 1 = $1 - P(0) - P(1)$ $P(0) = \frac{e^{-1.75} \times 1.75^0}{0!} = 0.1738$ $P(1) = \frac{e^{-1.75} \times 1.75^1}{1!} = 0.3041$ $\therefore P(>1) = 1 - 0.1738 - 0.3041 = 0.5221$																																							
7.	<table><tr><th>x</th><th>y</th><th>x²</th><th>xy</th></tr><tr><td>2</td><td>5</td><td>4</td><td>10</td></tr><tr><td>4</td><td>11</td><td>16</td><td>44</td></tr><tr><td>6</td><td>15</td><td>36</td><td>90</td></tr><tr><td>8</td><td>19</td><td>64</td><td>152</td></tr><tr><td>10</td><td>24</td><td>100</td><td>240</td></tr><tr><td>12</td><td>28</td><td>144</td><td>336</td></tr><tr><td>14</td><td>33</td><td>196</td><td>462</td></tr><tr><td>Σ 54</td><td>135</td><td>560</td><td>1334</td></tr></table> $\bar{x} = \frac{54}{7} = 7.71$ $\bar{y} = \frac{135}{7} = 19.29$ $m = \frac{1334 - (7)(7.71)(19.29)}{560 - (7)(7.71^2)}$ $= \frac{292.9187}{143.8913} = 2.036$ $c = 19.29 - (7.71 \times 2.036)$ $= 3.592$ $y = 2.036x + 3.592$				x	y	x ²	xy	2	5	4	10	4	11	16	44	6	15	36	90	8	19	64	152	10	24	100	240	12	28	144	336	14	33	196	462	Σ 54	135	560	1334
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