



OUTSTANDING SCHOLARSHIP EXEMPLAR



Scholarship 2015 Calculus

2.00 p.m. Tuesday 17 November 2015 Time allowed: Three hours Total marks: 40

ANSWER BOOKLET

There are five questions in this examination. Answer ALL FIVE questions, choosing ONE option from part (b) of Question Four.

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

Write ALL your answers in this booklet.

Make sure that you have Formulae and Tables Booklet S-CALCF.

Show ALL working. Start your answer to each question on a new page. Carefully number each question.

Answers developed using a CAS calculator require **ALL** commands to be **shown**. Correct answers only will not be sufficient.

Check that this booklet has pages 2–27 in the correct order and that none of these pages is blank.

The diagram for Question Four (b) Option 2 is on page 27 of this booklet.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

This examination consists of five questions. Answer all FIVE questions, choosing ONE option from part (b) of Question Four.

QUESTION NUMBER	
$\int_{1}^{3} \left(2\pi \left(x^{3} + \frac{1}{12x}\right) \sqrt{1 + \left(3x^{2} - \frac{1}{12x^{2}}\right)^{2}}\right) dx$	
$=2\pi\int_{1}^{3}\left(\varkappa^{3}+\frac{1}{12\varkappa}\right)\sqrt{1+\left(9\varkappa^{4}-\frac{1}{2}+\frac{1}{144\varkappa^{4}}\right)}d\varkappa$	The state of the s
$=2\pi\int_{1}^{3}(x^{3}+i\infty)\sqrt{9x^{4}+0.5+i44x^{4}}$).	
$= 2\pi \int_{0}^{3} \left(\chi^{3} + \frac{1}{12} \chi \right) \sqrt{\left(3 \chi^{2} + \frac{1}{12} \chi \right)^{2}} dx$	
$=2 + \int_{1}^{3} (\xi^{3} + 12 \kappa) (3 \chi^{2} + 12 \kappa^{2}) d\kappa$	
$= 2\pi \int_{-2}^{3} \left(3x^{5} + \frac{2}{4} + \frac{1}{12} + \frac{1}{144x^{2}}\right) dx$	
$=2\pi \int_{0}^{3} \left(3x^{5} + \frac{2}{3} + 144x^{2}\right) dx$	
SAT DEFT TO	
$= 2\pi \left[\frac{2^{6}}{2} + \frac{k^{3}}{6} + \frac{1}{288 k^{2}} \right]^{3}$	ANTA TO TO A ANTHORNOUS ANTHORN
$=2\pi\left(\left(\frac{3^{6}}{2}+\frac{3^{2}}{6}-\frac{1}{288\times 3^{2}}\right)-\left(\frac{1^{6}}{2}+\frac{1^{2}}{6}-\frac{1}{288\times 1^{2}}\right)\right)$	P TRANS. 1 A JANUAR AT
$=2\pi\left(\left(\frac{729}{2}+\frac{3}{2}-\frac{1}{2592}\right)-\left(\frac{1}{2}+\frac{1}{6}-\frac{1}{289}\right)\right)$	
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$\int \frac{dy}{dy} dy = \int \int dx$	
1-21/2 = x+C 0	
$-\frac{1}{z+c} = 2y^2$	
$-\frac{1}{2k+C}=y^2$	
y=± /petc MEI	~~~
As 5(0)=2	1
$2=\pm\sqrt{\frac{1}{2\kappa^{0}+C}}$	

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1.b. (cont)	2=+ \(\frac{1}{6} \)
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ne majame eena jarankan aksend	$\frac{dn}{dt} = (0.8 \times 6) - (\frac{n}{280} \times 6)$
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ayaya hara 🗸 milamikayana, a sadi	- 100 Sp. 160 der = 100 Side
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AND THE RESERVE	$m = A e^{\frac{3t}{100}} + 160$
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$9^{32x+4y} - 3^{3x} \times 3^{4y} = 106$	and the state of t
9 2xty - 32xty - 6	
34×+24-32×+4=6	
32x+4 (32x+4-1)=6	
$u = 3^{2k+n}$	**************************************
$u(u\bar{b}1)=6$	
$u^2 \bar{\mu} u - b = 0$	
(u+2)(u+3)=0	and the second s
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3 = -2 or 3	
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2×+y=1,	
y=>1-2k	
logx+1(1-2k+3) + logx+1 (1-2k+k+4)=3 .	
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logx+1 ((4-22)(5-2))=3	
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$log_{2+1}(22^{2}-142+20)=3$ $log_{2+1}(22^{2}-142+20)=3$ $\times +1 = (2+1)$	
$2\kappa^{2}-14\kappa+20=(\kappa+1)(\kappa^{2}+2\kappa+1)$	
$2k^2 - 14k + 20 = k^3 + 3k^2 + 3k + 1$	
$0 = 2^{3} + 2^{2} + 172 - 19$	
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y=1-2/2	
y = 1 - 2	
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- system professionings or	4=100, x=-100	y=\$00, x 5100
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	$a = \frac{1}{160}$	$a = -\frac{1}{100}$
	4= 100	x = 100
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	$\frac{dy}{dz} = \frac{z}{50}$ $\frac{z}{50} = \frac{50-z}{100-y}$	1 1 2 - 30 No. 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
	$y = \frac{100}{100}$ $\frac{y}{50} = \frac{50 - 2}{100}$	
	$\frac{50}{50} = \frac{30}{100 - \frac{20}{100}}$	
	あ(と(100-100))=50-と	
	50 (100x- 100)=50-2	
· marrier programme co	$2k - \frac{k^3}{5000} = 30 - k$	
garage a second construction of	$0 = \frac{\cancel{5000} - 3\cancel{2} + 50$	
	~ 113.09, 16.99 or -130	0.08 (by calculator)
	X=130.08 is before the car sta	te
	x ≈ 113.09 is when the rear ligh	Its illuminate the statue
	: x 2 16.99 384433	
	y = 100	
· —	y × 2.888//	
alamanyan aras albana a	45	
	$\frac{dS}{ds} = kS(N-S)$	
	$\frac{dS}{dt} = k(SN - S^2)$	
	$\frac{ds}{sN-s^2} = \frac{ds}{dt} = k$	
	$\int \frac{ds}{sN-s^2} \frac{ds}{dt} dt = \int k dt$	
	S SN-5° dS = Alekt+c/	

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b.)	A CONTRACTOR OF THE PROPERTY O	
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	$\frac{1}{S(N-S)} = \frac{A}{S} + \frac{B}{N-S}$	
	i = A(N-S) + BS	
	I = AN - AS + BS	
· · · · · · · · · · · · · · · · · · ·	A = B	• •
	12AN	
	$A = \sqrt{1} = B$	- /
	$\overline{S(N-S)} = \overline{NS} + \overline{N^2 - SN}$	
	JNS + N=-SN dS - 12+C	
	NS 3+ N=5 dS = K+C °	***
	n(WISIAWIN-51)=k+C	
	$l_n\left(\frac{s}{N-s}\right) = Nkt + C$	
	S. Net +C No. 1 Nk++C	e :
	S = (N-S)&	
	27 (N-3) Ae Nto	
	2 = (N-2) Ae NEXO	
,	$2 = (N-2)A \times 1$	
	$A = \frac{2}{N-2}$	
error semme decre	$S = (N-S) \Leftrightarrow \frac{2}{N-2} e^{Nt}$	
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	N/th) 2 N/th	
	N star a New	
	S= I+ R= entry	mga - 1
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	S=N+100 1+ 1-NAC	***
	$S = \frac{1}{1 + \frac{N-2}{N^2}} e^{-Nk\delta}$	1

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$3a D = 1050 + i \sin \theta$	
$3a D = los \theta + i sin \theta$ $p^{n} = (los \theta + i sin \theta)^{n}$ $for A$	
$z^{n} + \frac{1}{z^{n}} = (\cos\theta + i\sin\theta)^{n} + (\cos\theta + i\sin\theta)^{n}$	
Calculus 93202, 2015	

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3.L.	$log_{1} log_{2} (2sin x-1) - log_{2} (2sin x-1) -$
	2 = 25ù £ 1
	$(2\sin x - 1)^2 = 2 - 2y$
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the control of the second of t	$0 \leq (2\sin \kappa - 1)^2 \leq 9$
·	0 \le 2 - 2 y \le 9
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· · · (-7 < 2y < 2 -2 < Ay < 1
3.L.	4-05 ² 2×-4-05 ² ×+35W ² × 4-05 ² (=-×)-5W ² (2(x-1T))
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and the second second	= 4 cos2 (x-==)-sin22x
	$= \frac{16 \cos^4 x - 16 \cos^2 x + 4 - 4 \cos^2 x + 3 \sin^2 x}{4 \sin^2 (x) - (2 \sin x \cos x)^2}$
ass are in the articles	162054x-20252x+35h2x+4
	= 4 sin 2k - 4 sin 2k 1032k
in any complete to the	16.654x-20.652x+3(1-2052x)+4
	$= 4 \sin^2 x (1 - \cos^2 x)$
beings, orders somewhere	$= \frac{16 \cos^4 k - 20 \cos^3 k + 3 - 3 \cos^2 k + 4}{4 \sin^2 k \left(\sin^2 k \right)}$
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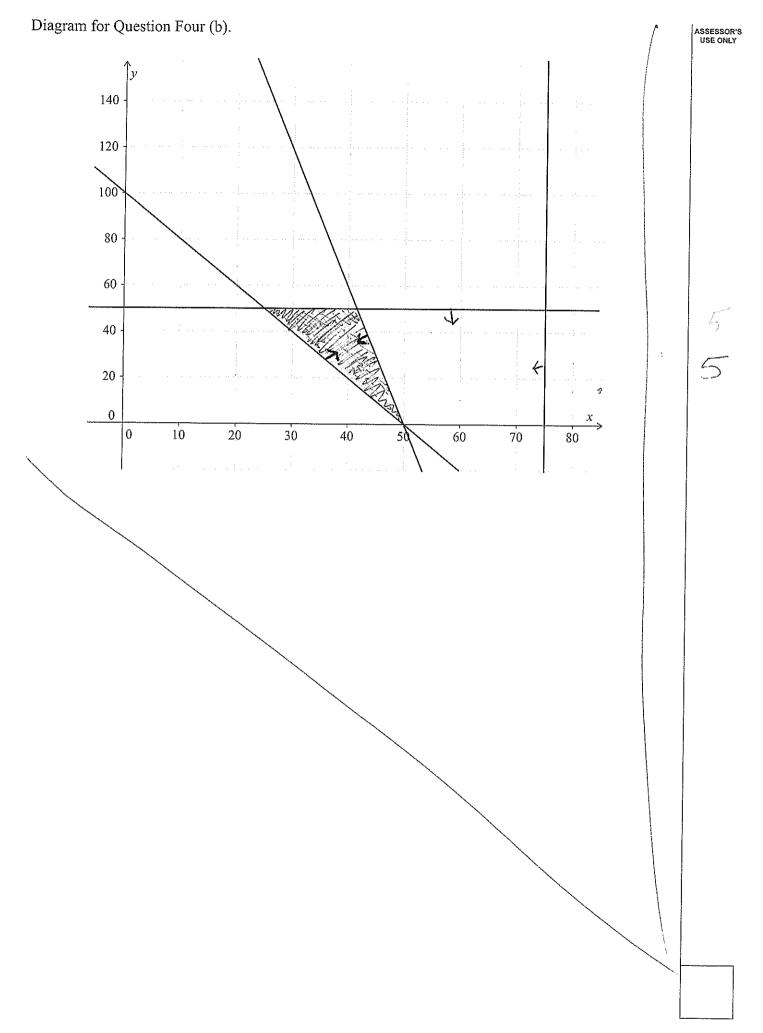
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•	3x+4y+52>6x+2y+22		Notes that the second s	
	2y+32>3x ·	<u> </u>		
	6x+2y+212 ≤500.	<u>(3)</u>		
,, , ,	3x+4y+5x < 400	<u> </u>		
,	3x+4y+22 < 300.	<u> </u>		
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	2x+g > 100	<u> </u>		
	2y+300-3k-34>3k	and annual contract of principle contracts of the state o		
a services	300-y>6x, y=300-6x	6)	.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	
	$6x+2y+200-2x-2y \leq 500$			
	4×≤300, ≥≤75 ·	<u>(b)</u>	yan ay sasar in sasar saa saa saa saa saa saa saa saa s	
	3x+4y+500-5x-5y≤400	a de la seria de la compansión de la compa		
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romal m = - tugeram	
$=$ $\frac{1}{2k}$	
y=- 1/2 x + 2	
kx2 = - 2kx0 x0+ c	
$c = k x_0^2 + \frac{1}{2k x_0} x_0$	
$c = k \chi^2 + \frac{1}{2k}$	
y= -1 2 xx x + kx 2 + -1/2 .	
.b. Intersection with other arm a	(x., 4)
4, = -1 × + L K 2 + ==	
$y_1 = k x_1^2 //$	3 To 10 To 1
LX2= 2kx0 x,+kx2+2k	
LX2+2LX0 ×, A (LX) + 2k)=0
上, = -2/200 ± √ 4/200 + 4/2 (L/20 + 5/20)	(plus gives greater value of x,, so orginal intersection, so minus needed)
	- headed)
X = - 1/2 /4 Exis+4k220+	
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$y_{i} = k k_{i}^{2}$ $2 \times 2 \times 2$	An entered to experimental experimental and an extended above 10 April 10 A	
ANT ME Z	DESCRIPTION OF THE PROPERTY OF	
$ \frac{4\pi \sqrt{M} \times 2}{\sqrt{k} = x}, \qquad (\text{regative 'scause body's for left arm}) $ $ y_1 = \frac{x-1}{2k \times 0} \times \sqrt{\frac{x}{k}} + k \times \frac{2}{0} + \frac{1}{2k} $		
y= 2/x, 1/2 + K2, +2/2		
$y_1 = \frac{1}{2kx_0}\sqrt{\frac{4}{k}} + kk^2 + \frac{1}{2k}$		
W. J. W. T.		
M. The state of th	Actualization and activities activities and activities activities and activities activities and activities	
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$ \frac{dy_1}{dx_0} = \left(\frac{1}{2L\sqrt{E}x_0} \times \frac{dy_1}{dx_0} \frac{1}{2}(y_1)^{\frac{1}{2}}\right) + \left(-\frac{1}{2L\sqrt{E}x_0^2}(y_1)^{\frac{1}{2}}\right) + k\chi_0^2 $ Minimum when $\frac{dy_1}{dx_0} = 0$	+ 22	
Minimum when $\frac{dv}{dx} = 0$		
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Annotated Exemplar for 93202 Calculus Outstanding Scholarship		Total Score	32		
Question	Mark	Annotation			
1	8	The candidate has shown algebraic competence in 1a in recognising the perfect square and used efficient integration techniques in 1a and 1b . The candidate also set up the correct differential equation in 1c and found its solution.			
2	8	The candidate has provided evidence in 2a of competently solving simultaneous equations with logarithms and exponents. The candidate recognised and correctly used partial fractions in 2c . The candidate correctly understood the relationship between the tangent and the curve in 2b .			
3	6	The candidate did not give an adequate proof or expansion in 3a . The candidate made progress in 3b to obtain an equation in one variable but did not recognise the restricted range of the expression. The candidate has shown competence in 3c in simplifying and expanding trigonometric expressions and sound use of trigonometric identities.			
4	6	The candidate was unable to explain conditions for a solution in 4a . In 4b Option 2 , the candidate has communicated clearly the equations which describe the linear programming context. The equations have been correctly simplified to be in two variables and the feasible region shaded.			
5	4	The candidate has made progress to obtain the equation of the normal to the curve at a general point in 5a . Inadequate attempts were made at 5b and 5c .			