

Exam Solutions/Mark Scheme

Section A				Qu total
1.	$3(5x+2) - 2(2-3x) = 9$ $15x + 6 - 4 + 6x = 9$ $21x + 2 = 9$ $21x = 9 - 2$ $x = \frac{7}{21} = \frac{1}{3}$	2		5
2.	(i) $2A - 3B = \begin{pmatrix} 6 & -4 \\ 4 & 2 \end{pmatrix} - \begin{pmatrix} 6 & -3 \\ 9 & 3 \end{pmatrix}$ $= \begin{pmatrix} 0 & -1 \\ -5 & -1 \end{pmatrix}$ (ii) $AC = \begin{pmatrix} 3 & -2 \\ 2 & 1 \end{pmatrix} \begin{pmatrix} 4 & -2 & 3 \\ 2 & 3 & 1 \end{pmatrix}$ $= \begin{pmatrix} 8 & -12 & 7 \\ 10 & -1 & 7 \end{pmatrix}$ (iii) $B^{-1} = \frac{1}{2 - (-3)} \begin{pmatrix} 1 & 1 \\ -3 & 2 \end{pmatrix}$ $= \frac{1}{5} \begin{pmatrix} 1 & 1 \\ -3 & 2 \end{pmatrix}$ $= \begin{pmatrix} 1/5 & 1/5 \\ -3/5 & 2/5 \end{pmatrix}$	2	5	
3.	$S = 5t^3 - 3t^{-2} + t^{1/2}$ $\frac{ds}{dt} = 15t^2 + 6t^{-3} + \frac{1}{2}t^{-1/2}$	2	3	5

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4	(1) $Z_1 = 5 - j4$  $r = \sqrt{5^2 + 4^2} = 6.4$ $\theta = \tan^{-1}\left(\frac{4}{5}\right) = 38.66$ $Z_1 = 6.4 \angle -38.66$ $Z_2 = 3 + j2$  $r = \sqrt{3^2 + 2^2} = 3.6$ $\theta = \tan^{-1}\left(\frac{2}{3}\right) = 33.7$ $Z_2 = \cancel{3.6 \angle 33.7} \cdot 3.6 \angle 33.7^\circ$ (i) $Z_1 Z_2 = 6.4 \angle -38.66 \times 3.6 \angle 33.7$ $= 23.04 \angle -4.96$ (ii) $\frac{Z_1}{Z_2} = \frac{6.4 \angle -38.66}{3.6 \angle 33.7}$ $= 1.78 \angle -72.36$	3	3	
		2		
		2		10
5	$\int_0^{\pi/2} (4 \cos 2x - 6 \sin 3x) dx$ $= \left[2 \sin 2x + 2 \cos 3x \right]_0^{\pi/2}$ $= \left[2 \sin \pi + 2 \cos (3\pi/2) \right] -$ $\left[2 \sin 0 + 2 \cos 0 \right]$ $= 0 - 2 = -2$	3	3	
		2		8

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20)	$\int_0^1 \frac{1}{(3x+2)^4} dx$ let $u = 3x+2$ $\frac{du}{dx} = 3$ $\frac{1}{3} du = dx$ $\therefore \int \frac{1}{(3x+2)^4} dx = \int \frac{1}{u^4} \cdot \frac{1}{3} du$ $= \int \frac{1}{3} u^{-4} du$ $= \frac{1}{3} \cdot \frac{u^{-3}}{-3}$ $= -\frac{u^{-3}}{9}$ $= \left[-\frac{1}{9(3x+2)^3} \right]_0^1$ $= \left[-\frac{1}{1125} \right] - \left[-\frac{1}{72} \right]$ $= 0.0148.$	2 2 2 2 2	10.

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							Qu total
3(i)	x	f	xf	$f(x - \bar{x})^2$			
	5	6	30	3003.844			
	15	17	255	2603.391			
	25	25	625	141.016			
	35	19	665	1104.672			
	45	10	450	3106.406	5		
	55	3	165	2289.422	2		
	Σ	80	2190	12248.751	2		
	$\bar{x} = \frac{2190}{80} = 27.375$				2		
	$\sigma = \sqrt{\frac{12248.751}{80}} = 12.37$				4		
(ii)(a)	$P(\text{both}) = 0.35 \times 0.65$ $= 0.2275$				3		
(b)	$P(\text{neither}) = 0.65 \times 0.35$ $= 0.2275$						
	$\therefore P(\text{connection}) = 1 - 0.2275$ $= 0.7725$				4		20

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4(i)	(a) $y = \frac{e^{3x}}{\sin 2x}$ Let $u = e^{3x}$ $v = \sin 2x$ $\frac{du}{dx} = 3e^{3x}$ $\frac{dv}{dx} = 2 \cos 2x$ $\frac{dy}{dx} = \frac{(\sin 2x)(3e^{3x}) - (e^{3x})(2 \cos 2x)}{(\sin 2x)^2}$ $= \frac{3e^{3x} \sin 2x - 2e^{3x} \cos 2x}{(\sin 2x)^2}$	2	3	
	(b) $y = 3 \sin(3x-4)$ Let $u = 3x-4$ so $y = 3 \sin u$. $\frac{du}{dx} = 3$ $\frac{dy}{du} = 3 \cos u$ $\frac{dy}{dx} = 3 \times 3 \cos u = 9 \cos(3x-4)$	2	3	
4(ii)	$y = 3x^3 - 4x^2 - 3x - 3$ $\frac{dy}{dx} = 9x^2 - 8x - 3$ for stat pt $0 = 9x^2 - 8x - 3$ $x = \frac{8 \pm \sqrt{(-8)^2 - 4(9)(-3)}}{2(9)}$ $= 1.17 \text{ or } -0.284$ if $x = 1.17$, $y = -7.18$ $x = -0.284$, $y = -2.54$	2	1	
	$\frac{d^2y}{dx^2} = 18x - 8$ if $x = 1.17$ +ve so min if $x = -0.284$ -ve so max.	3		
				20.