香港考試及評核局 HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY

2 0 1 2 年 香 港 高 級 程 度 會 考 HONG KONG ADVANCED LEVEL EXAMINATION 2012

數學及統計學 高級補充程度

MATHEMATICS AND STATISTICS AS-LEVEL

評 卷 參 考

MARKING SCHEME

本評卷參考乃香港考試及評核局專為今年本科考試而編寫,供閱卷員參 考之用。閱卷員在完成閱卷工作後,若將本評卷參考提供其任教會考班 的本科同事參閱,本局不表反對,但須切記,在任何情況下均不得容許 本評卷參考落入學生手中。學生若索閱或求取此等文件,閱卷員/教師 應嚴詞拒絕,因學生極可能將評卷參考視為標準答案,以致但知硬背死 記,活剝生吞。這種落伍的學習態度,既不符現代教育原則,亦有違考 試着重理解能力與運用技巧之旨。因此,本局籲請各閱卷員/教師通力合 作,堅守上述原則。

This marking scheme has been prepared by the Hong Kong Examinations and Assessment Authority for markers' reference. The Authority has no objection to markers sharing it, after the completion of marking, with colleagues who are teaching the subject. However, under no circumstances should it be given to students because they are likely to regard it as a set of model answers. Markers/teachers should therefore firmly resist students' requests for access to this document. Our examinations emphasise the testing of understanding, the practical application of knowledge and the use of processing skills. Hence the use of model answers, or anything else which encourages rote memorisation, should be considered outmoded and pedagogically unsound. The Authority is counting on the co-operation of markers/teachers in this regard.

General Instructions To Markers

- 1. It is very important that all markers should adhere as closely as possible to the marking scheme. In many cases, however, candidates will have obtained a correct answer by an alternative method not specified in the marking scheme. In general, a correct alternative solution merits <u>all the marks</u> allocated to that part, unless a particular method has been specified in the question. Markers should be patient in marking alternative solutions not specified in the marking scheme.
- 2. For the convenience of markers, the marking scheme was written as detailed as possible. However, it is likely that candidates would not present their solution in the same explicit manner, e.g. some steps would either be omitted or stated implicitly. In such cases, markers should exercise their discretion in marking candidates' work. In general, marks for a certain step should be awarded if candidates' solution indicated that the relevant concept / technique had been used.
- 3. In marking candidates' work, the benefit of doubt should be given in the candidates' favour.
- 4. Unless the form of the answer is specified in the question, alternative simplified forms of answers different from those in the marking scheme should be accepted if they are correct.
- 5. Unless otherwise specified in the question, use of notations different from those in the marking scheme should not be penalised.
- 6. In the marking scheme, marks are classified into the following three categories:

'M' marks	_	awarded for applying correct methods
'A' marks	-	awarded for the accuracy of the answers
Marks without 'M' or 'A'	-	awarded for correctly completing a proof or arriving at an answer given in the question.

In a question consisting of several parts each depending on the previous parts, 'M' marks should be awarded to steps or methods correctly deduced from previous answers, even if these answers are erroneous. (I.e. Markers should follow through candidates' work in awarding 'M' marks.) However, 'A' marks for the corresponding answers should <u>NOT</u> be awarded, unless otherwise specified.

- 7. In the marking scheme, steps which can be skipped are enclosed by dotted rectangles, whereas alternative answers are enclosed by solid rectangles.
- 8. Marks may be deducted for poor presentation (pp). The symbol (pp-1) should be used to denote 1 mark deducted for pp.
 - (a) At most deduct 1 mark for pp in each section.
 - (b) In any case, do not deduct any marks for pp in those steps where candidates could not score any marks.
- 9. Marks may be deducted for numerical answers with inappropriate degree of accuracy (a). The symbol (a-1) should be used to denote 1 mark deducted for a.
 - (a) At most deduct 1 mark for a in each section.
 - (b) In any case, do not deduct any marks for a in those steps where candidates could not score any marks.

		Solution	Marks	Remarks
, 1.	(a)	$a^{3} + b^{3} = (a+b)(a^{2} - ab + b^{2})$	1A	
		en e		and instruction which is a pro-
	(b)	(i) $(1+4x)^2$ (1) $1(-1)(-1)(-1)(-1)(-1)(-1)(-1)(-1)(-1)(-1$		alternative solution mon
		$=1+\left(\frac{-1}{2}\right)(4x)+\frac{1}{2!}\left(\frac{-1}{2}\right)\left(\frac{-1}{2}-1\right)(4x)^{2}+\frac{1}{3!}\left(\frac{-1}{2}\right)\left(\frac{-1}{2}-1\right)\left(\frac{-1}{2}-2\right)(4x)^{3}+\cdots$	1 M	Ningella manipulation and the second
		$= 1 - 2x + 6x^2 - 20x^3 + \cdots$	1A	i to movine and all all
		$\frac{1}{2}$		 wild sold protocol there are closed, realifiered filled id are
		$(1+64x^3)^2$		bai naukite senditiona b
		$=1+\left(\frac{1}{2}\right)(64x^{3})+\cdots$		
		$=1+32x^3-\cdots$	1A	an sensitivers for an
		(ii) :: $1+64x^3 = (1+4x)(1-4x+16x^2)$. call to reach the head of the a
		$\frac{1}{1-4x+16x^2}\frac{1}{2}-(1+64x^3)\frac{1}{2}(1+4x)\frac{-1}{2}$	1M	d blands worder and haat
		$= (1+32x^3 - \dots)(1-2x+6x^2 - 20x^3 + \dots)$	1141	
		$= 1 - 2x + 6x^2 + 12x^3 + \cdots$	1A	
		and interview for the low front with several and	(6)	in the marking schemes, p
		2		
2.	(a)	$y = e^{t^2 + 4t^2 + 4}$ and $x = \ln(2t + 4)$		eine A
		$\frac{dy}{dt} = e^{t^2 + 4t + 4} (2t + 4)$ and $\frac{dx}{dt} = \frac{1}{1}$	1A	For both
				a generativ decessed the set
		$\frac{d}{dx} = \frac{d}{dt} \div \frac{d}{dt}$		e-14 salemes a 2009 7 belies
		$=2e^{t^{2}+4t+4}(t+2)\cdot(t+2)$	1M	
		Alternative Solution	distant f	n meneriae generation sea acco
		$\ln y = (t+2)^2$ and $x = \ln 2 + \ln(t+2)$		OR \cdots and $t+2=\frac{1}{2}e^x$
		$\therefore x = \ln 2 + \frac{1}{2} \ln(\ln y)$	1A	OR $\ln y = \frac{1}{4}e^{2x}$
		dx = 1 1 1	1M	$\frac{4}{0R} = \frac{1}{2} \frac{dy}{dx} = \frac{1}{2} \frac{a^{2x}}{a^{2x}} + 2$
		$\frac{dy}{dy} = \frac{2}{2} \frac{\ln y}{\ln y} \frac{y}{y}$	1111	$\frac{\partial R}{\partial y} \frac{\partial r}{\partial x} \frac{\partial r}{\partial t} \frac{\partial r}{\partial t} \frac{\partial r}{\partial t} \frac{\partial r}{\partial t}$
		$\frac{dy}{dt} = 2 y \ln y$	1A	enes E bestalinati ani vermi sifariki
		dx = 25 m/s		drade 1 mark defaiter?
	(b)	$\frac{d^2 y}{dt^2} = \left(2y \cdot \frac{1}{dt} + 2\ln y\right) \frac{dy}{dt}$	1M	For chain rule
	(0)	$dx^{2} \left(-\frac{y}{y} \right) dx$		
		$-3 \qquad \frac{1}{2}$		
		When $x = 0$, $t = \frac{3}{2}$ and so $y = e^4$.	1A	
		$\therefore \frac{d^2 y}{2} = 4e^{\frac{1}{4}} \left(\frac{1}{1}\right) \left(1 + \frac{1}{1}\right)$	i	
		$dx^2 (4) 4)$		
		$=\frac{5}{4}e^{\overline{4}}$	1A	OR 1.6050
			(6)	1

	Solution	Marks	Remarks
. (a)	Let $u = 1 + e^{-0.2t}$.		前月19月4日につける (1)
	$\mathrm{d}u = -0.2e^{-0.2t}\mathrm{d}t$	1A	
	$10.3e^{-0.2t}$		
	$N = \int \frac{1}{(1 + e^{-0.2t})^2} dt$	11	CARE ALL NOT THE
	$N = \int 0.3 \mathrm{d}u$		
	$N = \int \frac{1}{u^2} \cdot \frac{1}{-0.2}$		
	$=\frac{3}{C}+C$	1A	
	2u		
	$=\frac{3}{2(1-\frac{-0.2}{2})}+C$		Same and the second
	$2(1+e^{-1})$		
	when $t = 0$, $N = 0.5$.		
	$\therefore C = \frac{1}{4}$		
	i.e. $N = \frac{3}{1} = \frac{1}{1}$	14	
	$1.2. N = \frac{1}{2(1+e^{-0.2t})} = \frac{1}{4}$		
		200	
(b)	N(4) - N(0)	and the	6.19
	$=\frac{3}{100000000000000000000000000000000000$	1 M	
	$2(1+e^{-0.2x^4})$ 4		
	≈ 0.284961721 Hence the increase in the number of people is 285	14	
	There are increase in the number of people is 200.		
(\cdot)	$dN = 0.3e^{-0.2t}$		
(c)	$\frac{1}{dt} = \frac{1}{(1+e^{-0.2t})^2} > 0 \text{for all } t \ge 0$		Withhold the last mark in
	Hence N is always increasing.		this argument is missing
	$\lim_{N \to \infty} M = \lim_{n \to \infty} \begin{bmatrix} 3 & 1 \end{bmatrix}$		OR by arguing that
	$\lim_{t \to \infty} 1^{v} = \lim_{t \to \infty} \left[\frac{2(1 + e^{-0.2t})}{2(1 + e^{-0.2t})} - \frac{1}{4} \right]$		$e^{-0.2t} > 0 \Rightarrow N < \frac{3}{2}$
	=1.25	1A	$e \rightarrow 0 \rightarrow N < \frac{2}{2}$
	Hence the number of members will never reach 1300.	1	OR by arguing that
		(7)	$\frac{3}{2(1+e^{-0.2t})} - \frac{1}{4} = 1.3$
			has no real solution
(a)	Lat V he the number of defective peaks in a day		
(a)	Let X be the number of defective packs in a day. $a^{-\lambda} 2^0$		and the last of the
	$P(X \ge 1) = 1 - \frac{e^{-\chi}}{0}$	1A	C providence and the real of the
	$1 - e^{-2} = 1 - e^{-\lambda}$	1000	
	i.e. $\lambda = 2$	1A	
	Table Division and the second s		
(b)	P(the company will have to inspect the production line in a given day) = $P(K > 4)$		
	$= P(X \ge 4)$	ing to the original	1-6-1-6-1-6-1-6-
	$=1-e^{-2}-\frac{e^{-2}2^{1}}{2}-\frac{e^{-2}2^{2}}{2}-\frac{e^{-2}2^{3}}{2}$	1 M	in the refer densities of T
	$2! 3! \approx 0.142876539$		145 - F 1 1 1 1
	≈ 0.1429	1A	The second in the
(c)	$(1 - 0.142876539)^n > 0.5$	1M	1
	$n\ln(1-0.142876539) > \ln 0.5$		
	n < 4.495896098	1.4	100
	1.e. the greatest integral value of n is 4.	IA	
		(6)	1

.

	()	Solution Solution	Marks	Remarks
5.	(a)	$P(A \cap B) = P(A)P(B \mid A)$		
		$=\frac{3a}{8}$	1A	1.0° al.0
	(b)	$P(A \cap B) = P(B)P(A \mid B)$		
		$\frac{3a}{8} = \frac{3}{4} P(B)$	1M	
		$P(B) = \frac{a}{2}$	1A	
	(c)	(i) $P(A \cup B) - P(A) + P(B) - P(A \cap B)$		
	(0)	7 a 3a	114	A A CALL HE REAL
		$1 - \frac{1}{16} = a + \frac{1}{2} - \frac{1}{8}$	IM	지 말에 주말 같이 같이 같이 같이 같이 많이
		$a = \frac{1}{2}$	1A	
		(ii) $P(A B') = \frac{P(A \cap B')}{P(B')}$		1 7+12
		$P(A) - P(A \cap B)$		(d) is a doper
		$=$ $\frac{1-P(B)}{1-P(B)}$		A CARACTER A
		$\frac{1}{2} - \frac{3}{8} \times \frac{1}{2}$		= 0.23H_961721
		$=\frac{2}{1-\frac{1}{2}\times\frac{1}{2}}$	1M	For numerator
		$=\frac{5}{12}$	1A	The second second
		12	(7)	representation of sources of
. 1	(a)	$\frac{(30+a)+52+\dots+(90+b)}{30} = 71 \text{ and } (90+b)-(30+a) = 56$	1M+1M	
		a+b=10 and $b-a=-4Solving, a=7 and b=3$	1A	For both
				00.10(700
		803	1.4	
		$\sigma = \sqrt{\frac{803}{5}}$	1A	OR 12.6728
	(b)	$\sigma = \sqrt{\frac{803}{5}}$ P(3 of the excessive students will have scores higher than 80)	1A	OR 12.6728
	(b)	$\sigma = \sqrt{\frac{803}{5}}$ P(3 of the excessive students will have scores higher than 80) $C_3^7 C_1^6$	1A	OR 12.6728
	(b)	$\sigma = \sqrt{\frac{803}{5}}$ P(3 of the excessive students will have scores higher than 80) $= \frac{C_3^7 C_1^6}{C_4^{13}}$	1A 1M	OR 12.6728 OR $4 \cdot \frac{7}{13} \cdot \frac{6}{12} \cdot \frac{5}{11} \cdot \frac{6}{10}$
	(b)	$\sigma = \sqrt{\frac{803}{5}}$ P(3 of the excessive students will have scores higher than 80) $= \frac{C_3^7 C_1^6}{C_4^{13}}$ $= \frac{42}{143}$	1A 1M 1A	OR 12.6728 OR $4 \cdot \frac{7}{13} \cdot \frac{6}{12} \cdot \frac{5}{11} \cdot \frac{6}{10}$ OR 0.2937
	(b)	$\sigma = \sqrt{\frac{803}{5}}$ P(3 of the excessive students will have scores higher than 80) $= \frac{C_3^7 C_1^6}{C_4^{13}}$ $= \frac{42}{143}$	1A 1M 1A	OR 12.6728 OR $4 \cdot \frac{7}{13} \cdot \frac{6}{12} \cdot \frac{5}{11} \cdot \frac{6}{10}$ OR 0.2937
	(b) (c)	$\sigma = \sqrt{\frac{803}{5}}$ P(3 of the excessive students will have scores higher than 80) $= \frac{C_3^7 C_1^6}{C_4^{13}}$ $= \frac{42}{143}$ Let x_i (<i>i</i> = 1, 2,, 30) be the original data. The new standard deviation	1A 1M 1A	OR 12.6728 OR $4 \cdot \frac{7}{13} \cdot \frac{6}{12} \cdot \frac{5}{11} \cdot \frac{6}{10}$ OR 0.2937
	(b) (c)	$\sigma = \sqrt{\frac{803}{5}}$ P(3 of the excessive students will have scores higher than 80) $= \frac{C_3^7 C_1^6}{C_4^{13}}$ $= \frac{42}{143}$ Let x_i (<i>i</i> = 1, 2,, 30) be the original data. The new standard deviation	1A 1M 1A	OR 12.6728 OR $4 \cdot \frac{7}{13} \cdot \frac{6}{12} \cdot \frac{5}{11} \cdot \frac{6}{10}$ OR 0.2937
	(b) (c)	$\sigma = \sqrt{\frac{803}{5}}$ P(3 of the excessive students will have scores higher than 80) $= \frac{C_3^7 C_1^6}{C_4^{13}}$ $= \frac{42}{143}$ Let x_i (<i>i</i> = 1, 2,, 30) be the original data. The new standard deviation $= \sqrt{\frac{1}{30+2n} \left[\sum_{i=1}^{30} (x_i - \mu)^2 + n(\mu - \sigma - \mu)^2 + n(\mu + \sigma - \mu)^2 \right]}$	1A 1M 1A 1M	OR 12.6728 OR $4 \cdot \frac{7}{13} \cdot \frac{6}{12} \cdot \frac{5}{11} \cdot \frac{6}{10}$ OR 0.2937
	(b) (c)	$\sigma = \sqrt{\frac{803}{5}}$ P(3 of the excessive students will have scores higher than 80) $= \frac{C_3^7 C_1^6}{C_4^{13}}$ $= \frac{42}{143}$ Let x_i (<i>i</i> = 1, 2,, 30) be the original data. The new standard deviation $= \sqrt{\frac{1}{30+2n} \left[\sum_{i=1}^{30} (x_i - \mu)^2 + n(\mu - \sigma - \mu)^2 + n(\mu + \sigma - \mu)^2 \right]}$ $= \sqrt{\frac{1}{30+2n} (30\sigma^2 + n\sigma^2 + n\sigma^2)}$	1A 1M 1A 1M	OR 12.6728 OR $4 \cdot \frac{7}{13} \cdot \frac{6}{12} \cdot \frac{5}{11} \cdot \frac{6}{10}$ OR 0.2937
	(b) (c)	$\sigma = \sqrt{\frac{803}{5}}$ P(3 of the excessive students will have scores higher than 80) $= \frac{C_3^7 C_1^6}{C_4^{13}}$ $= \frac{42}{143}$ Let x_i (<i>i</i> = 1, 2,, 30) be the original data. The new standard deviation $= \sqrt{\frac{1}{30+2n} \left[\sum_{i=1}^{30} (x_i - \mu)^2 + n(\mu - \sigma - \mu)^2 + n(\mu + \sigma - \mu)^2 \right]}$ $= \sqrt{\frac{1}{30+2n} (30\sigma^2 + n\sigma^2 + n\sigma^2)}$ $= \sigma$	1A IM IA IM	OR 12.6728 OR $4 \cdot \frac{7}{13} \cdot \frac{6}{12} \cdot \frac{5}{11} \cdot \frac{6}{10}$ OR 0.2937
	(b) (c)	$\sigma = \sqrt{\frac{803}{5}}$ P(3 of the excessive students will have scores higher than 80) $= \frac{C_3^7 C_1^6}{C_4^{13}}$ $= \frac{42}{143}$ Let x_i ($i = 1, 2,, 30$) be the original data. The new standard deviation $= \sqrt{\frac{1}{30+2n} \left[\sum_{i=1}^{30} (x_i - \mu)^2 + n(\mu - \sigma - \mu)^2 + n(\mu + \sigma - \mu)^2 \right]}$ $= \sqrt{\frac{1}{30+2n} (30\sigma^2 + n\sigma^2 + n\sigma^2)}$ $= \sigma$ $= \sqrt{\frac{803}{5}}$	1A 1M 1A 1M	OR 12.6728 OR 4. 7/13 . 6/12 . 5/11 . 6/10 OR 0.2937 OR 12.6728

SolutionMarks7. (a)f(x) =
$$\frac{a+b}{c-x}$$
 gives $g(x) = \frac{-a+b}{c+x}$ Marks7. (a)f(x) = $\frac{a+b}{c-x}$ gives $g(x) = \frac{-a+b}{c+x}$ In A8. Since the vertical asymptotes of $C_2: y = g(x)$ is $2, -\frac{b}{c+2}$ In A $\frac{b}{c} = \frac{4}{3}$ (1) $\therefore b = 4$ Since the x-intercept of $C_2: y = g(x)$ is $2, -\frac{b}{a} = 2$ $\therefore b = 4$ (2) $\therefore a = 2$ (1)(b)(i) (i) (i) $\frac{b}{a} = \frac{2}{2}$ (2) $\therefore a = 2$ (2) $\therefore a = 2$ (2) (i) (2) $\frac{b}{a} = 2$ (2) (i) (1) $\frac{b}{c_2} = \frac{2}{2}$ (2) (i) (2) $\frac{b}{a} = \frac{2}{2}$ (2) (i) (1) $\frac{b}{c_2} = \frac{2}{2}$ (2) $\frac{b}{c_2} = \frac{2}{3}$ (2) $\frac{c_2}{c_2} = \frac{2}{3}$ (2) $\frac{c_2}{c_2} = \frac{2}{3}$ (2) $\frac{c_2}{c_2} = \frac{2}{3}$ (2) $\frac{c_2}{c_2} = \frac{2}{3}$

			Solution	Marks	Remarks
3.	(a)	Let	u=1+6t	1A	
		d <i>u</i> =	= 6 dt		양 이는 동생은 것이 같아?
		Whe	en $t = 0$, $u = 1$; when $t = 12$, $u = 73$	Ta an Aqu	the lacities with and
		1 2	$\left[-\frac{-2}{2}\right]$		
			$4.5 + 2t(1+6t)^{-3}$ dt		
		•0			
		ć	$\frac{73}{1-1}\left(\frac{-2}{2}\right) du$	114	P 14 1
		=]	$4.5 + \frac{1}{3}u^{-3}$	IM	For integrand
					김 과정이 관람이 많이 싶다.
		ſ	$73\left(3, 1, \frac{1}{3}, 1, \frac{-2}{3}\right)$		
		=]	$\frac{1}{4} \left[\frac{-4}{4} + \frac{1}{18} u^3 - \frac{-1}{18} u^3 \right] du$		
		_	73		
		3	$3u + 1 + \frac{4}{3} + 1 + \frac{1}{3}$	1.4	For primitive function
		= -	$\frac{1}{4} + \frac{1}{24}u^3 - \frac{1}{6}u^3$	IA	
		L			
		≈ 66	5.14060019		422 . 22 3/72
		∴ tł	to total amount of sewage emitted by machine $P \approx 66.1406$ tonnes.	1A	OR $\frac{433+23\sqrt{73}}{2}$ tonne
					8
				(4)	lignerical of L
				(1)	
					(ii) °
	(b)	(1)	$\int_{0} [3 + \ln(2t + 1)] dt$		
			12 - 0	114	
			$= \frac{1}{2(5)} \left[3 + \ln 1 + 3 + \ln 25 + 2(3 + \ln 5.8 + 3 + \ln 10.6 + 3 + \ln 15.4 + 3 + \ln 20.2) \right]$	IM	
			≈ 63.52367987		
			\therefore the total amount of sewage emitted by machine $Q \approx 63.5237$ tonnes.	1A	
		(ii)	$q''(t) = \frac{2}{1-t}$		
		()	2t+1	THE PARTY	4
			$q''(t) = \frac{-4}{2} < 0$ for all $t \ge 0$	1A	For $\frac{-4}{(2-4)^2}$
			$(2t+1)^2$		$(2t+1)^2$
			Hence the estimate in (b)(i) is an under-estimate.		
			Therefore we cannot conclude that the amount of sewage emitted by Q will be less than that by R and so the manager cannot be agreed with	} 1	
			will be less than that by F and so the manager calliot be agreed with.	J	
				(5)	
	(c)	(i)	$R = 16 - ae^{-bx}$		
			$\ln(16 - R) = \ln a - bx$	1A	
				12.21 (12.1-1)	s offer 1977
		(::)	$\int 1 = \ln a + 10b$	1M	E HI - Mar and All
		(11)	$0 = \ln a - 90b$		
			Solving $a = e^{0.9}$ and $b = 0.01$	1A+1A	OR <i>a</i> ≈ 2.4596
				and the	
		(iii)	Total amount of sewage		and the second
			$\approx 80 + 66.14060019 + 63.52367987$	1M	+ Cri W1-
			= 209.6642801		
			Hence $R = 16 - e^{0.9} e^{-0.01(209.6642801)}$		
			≈ 15.69779292	1.4	1
			1.e. the tax paid is 15.69/8 million dollars.	IA	
		,		(6)	- A Break (197
			그는 것이 말했다. 집 것 같아? 것 같아? 집 같은 것 같은 것 같아?		
				and the second	the second s

	Solution	Marks	Remarks
(a)	$r(t) = 20 - 40e^{-at} + be^{-2at}$	and apple	
	$r(0) = 20 - 40e^0 + be^0 = 30$	1 marsh	
	$\therefore b = 50$	· 1A	
		(1)	an many
(b)	r'(t) < 0 for 9 days	1M	
	$40ae^{-at} - 100ae^{-2at} < 0$ for $t < 9$	1 1 1 1	Rector to 9 (1971)
	$20ae^{-2at}(2e^{at}-5) < 0$		a.1 - 3cl - 1
	$e^{at} < 2.5$		45
	$t < \frac{\ln 2.5}{2}$	1A	
	a In 2.5	These (EU	
	$\therefore \frac{\text{III 2.5}}{\alpha} = 9$	1	- 201
	i.e. $a \approx 0.1$ (correct to 1 decimal place)	1A	
		(3)	
		(3)	
(c)	The rate of change of the rate of selling of handbags is $r'(t) = 4e^{-0.1t} - 10e^{-0.2t}$.	172.6 994	n hi distriction
(0)	d out of the off the o		
	$\frac{d}{dt}r'(t) = -0.4e^{-0.1t} + 2e^{-0.2t}$		·周县本居)省 ····································
	$d_{1}(t) = 0$ when $0.4e^{-0.1t} = 2e^{-0.2t}$	1M	
	$\frac{-1}{dt} r(t) = 0 \text{when } 0.4e = 2e$	a second	
	$e^{0.1t} = 5$		OB 16 0044
	$t = 10 \ln 5$		OK 10.0944
	$\frac{d^2}{dt}r'(t) = 0.04e^{-0.1t} - 0.4e^{-0.2t}$		
	$\frac{dt^2}{dt^2} (t) = 0.04c$	> 1M	OR by using sign test
	When $t = 10 \ln 5$ $\frac{d^2}{dt} r'(t) = -0.008 < 0$	in the	
	when $t = 10 \text{ m/s}$, dt^2		2 × 092
	Hence $r'(t)$ is maximum when $t = 10 \ln 5$	1 mila to	Alexandria da alexandria
	$r(10\ln 5) = 20 - 40e^{-0.1(10\ln 5)} + 50e^{-0.2(10\ln 5)} = 14$		OD 14000 man day
	The rate of selling = 14 thousand per day	IA	OK 14000 per day
	이 집에 가슴 걸었다. 그는 것이 같은 것이 같았다. 그 가지 않는 것이 같아.	(4)	
		Md ; _],	and the second se
(d)	(i) $r(t) = 20 - 40e^{-0.1t} + 50e^{-0.2t} < 18$	1M	
	$25e^{-0.2t} - 20e^{-0.1t} + 1 < 0$	1-1-5	
	$0.053589838 < e^{-0.1t} < 0.746410161$	(internet)	0.85-
	2.924800155 < t < 29.26395809	1A	and the second second
	$\therefore 29.26395809 - 2.924800155 = 26.33915794$	1.4	
	\therefore the 'sales warning' will last for 26 days.	IA	
	(ii) Number of handbags sold (in thousand) during the 'sales warning' period		0030.09
	(1) (29.26395809) $(20.40 - 0.11 + 50 - 0.21)$ (29.26395809)	1M	
	$= \int_{2.92480155} (20 - 40e^{-500} + 50e^{-500}) dt$	(his called	CALLER TRUE AND
	$= [20t + 400e^{-0.1t} - 250e^{-0.2t}]_{2226395809}^{2926395809}$		
	≈ 388.2190941	1A	Accept 388.2191
	388.2190941	1M	
	26.33915794 ≈ 14.7392	1.4	OP 15000
	Hence the average number of handbags sold per day is 15 thousand.	IA	OK 13000
		(7)	

Solution	Marks	Remarks
10. Let A and B be the operation time of a randomly chosen battery A and B respective	ely.	C ^{ar} stler Marstrick
(a) (i) $P(A < 152 \text{ or } A > 184)$ = $P\left(Z < \frac{152 - 168}{32} \text{ or } Z > \frac{184 - 168}{32}\right)$ = $P(Z < -0.5 \text{ or } Z > 0.5)$ = 0.617	1A	
(ii) $P(A > k) = 0.05$ $\frac{k - 168}{32} = 1.645$ k = 220.64	1M 1A	Accept 1.64 or 1.65 Accept 220.48 or 220.8
(iii) $P(B > 188) = 0.33$ and $P(B < 213.2) = 0.877$ $P\left(Z > \frac{188 - \mu}{\sigma}\right) = 0.33$ and $P\left(Z < \frac{213.2 - \mu}{\sigma}\right) = 0.877$ $\frac{188 - \mu}{\sigma} = 0.44$ and $\frac{213.2 - \mu}{\sigma} = 1.16$	1M	
σ σ Solving, $\mu = 172.6$ and $\sigma = 35$.	1A+1A	
(iv) $P(B < 146) = P\left(Z < \frac{146 - 172.6}{35}\right)$		tie maar ni dig di di di
= P(Z < -0.76) - 0.2236	1A	анбні (1) — (1) —
	(7)	2 650 i × 1
(b) (i) $\lambda_A = 1500 \times \frac{1}{3} \times P(A < 104)$ = 500 × P $\left(Z < \frac{104 - 168}{2} \right)$	1M <i>≤</i>	6.600 - (0)2 - 6.666 6.600 - 6.000
$= 500 \times P\left(Z < \frac{32}{32}\right)$ $= 500 \times P(Z < -2)$		Either one
= 11.4 (correct to 1 d.p.) $\lambda_B = 1500 \times \frac{2}{3} \times P(B < 104)$		स्ति वर्षे के स्वतं कर्षों
$= 1000 \times P\left(Z < \frac{104 - 172.6}{35}\right)$ = 1000 × P(Z < -1.96) = 25.0 (correct to 1 d.p.)	1A	Accept 25
(ii) P(4 ≤ number of 'faulty' batteries A produced ≤ 6) = $\frac{e^{-11.4}11.4^4}{4!} + \frac{e^{-11.4}11.4^5}{5!} + \frac{e^{-11.4}11.4^6}{6!}$	1M	1008409 5. 655. 65 647. 65 75. 45 - 5. 43 - 4
≈ 0.0600		ale estatelit (ii) anut es
(iii) The required probability $= \frac{\frac{e^{-11.4}11.4^4}{4!} \times \frac{e^{-25}25^6}{6!} + \frac{e^{-11.4}11.4^5}{5!} \times \frac{e^{-25}25^5}{5!}}{\frac{e^{-11.4}11.4^4}{4!} \times \frac{e^{-25}25^6}{6!} + \frac{e^{-11.4}11.4^5}{5!} \times \frac{e^{-25}25^5}{5!} + \frac{e^{-11.4}11.4^6}{6!} \times \frac{e^{-25}25^4}{4!}}{\frac{e^{-25}25^4}{4!}}$	1M+1M	1M for numerator 1M for denominator
4! 0! 5: 5: 0. H ≈ 0.8815	1A	26.22913 7 16700 - 1671
	(8)	1

		Solution	Marks	Remarks
11. (a)	(i)	$\frac{e^{-\lambda}\lambda^8}{2} = \frac{12.39}{122}$ and $\frac{e^{-\lambda}\lambda^9}{21} = \frac{8.26}{122}$	1M	
	()	$8!$ 120 $9!$ 120 $-\frac{1}{2}$ 120 $-$	1.1.1.1	
		Dividing, we have $\frac{e^{-\lambda}\lambda^2}{\Omega_1} \cdot \frac{8!}{-\lambda + 8} = \frac{8.26}{120} \cdot \frac{120}{12.39}$		
		$9! e^{-\lambda} 120 12.59$	1A	OR 6.0
		$C_7^{10} p^7 (1-p)^3 = \frac{25.80}{120}$ and $C_8^{10} p^8 (1-p)^2 = \frac{14.51}{120}$	1M	
		Dividing, we have $\frac{C_8^{10} p^8 (1-p)^2}{C_7^{10} p^7 (1-p)^3} = \frac{14.51}{120} \cdot \frac{120}{25.80}$		a sou phi
		$\frac{3p}{8(1-p)} = \frac{1451}{2580}$		La Jarres
		$p \approx 0.6$ (correct to 1 decimal place)	1A	$\frac{2902}{4837}$ not acceptable
	(ii)	$a = \frac{e^{-6} 6^7}{120} \cdot 120 \approx 16.52$)	
	, í		14	1 A for any two correct
		$b = \frac{e^{-66}}{10!} \cdot 120 \approx 4.96$		1A for the other two correct
		$c = C^{10}(0.6)^9(0.4) \cdot 120 \approx 4.84$	(1,1,2)	(티)(티) 이 이 이 이 이 이 이 이 이 이 이 이 이 이 이 이 이 이 이
		$d = (0.6)^{10} \cdot 120 \approx 0.73$	J	
		$u = (0.0)^{-120} \sim 0.75$	sheet 11	The state access
	(iii)	For the number of new born babies diagnosed with congenital diseases greater than 10, the expected frequency by Po(6) is	të treni un CE Lici	(1999) an ann a' ann a' ann a' a' ann a'
		$120 - 72.76 - 16.52 - 12.39 - 8.26 - 4.96 \approx 5.11$	IM	「時」に対しておかいという
		The sum of errors for model fitted by Po (6) is		1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1
		$E_1 = 74 - 72.76 + 20 - 16.52 + 14 - 12.39 + 8 - 8.26 + 4 - 4.96 + 0 - 5.11 $	1.4	
		= 12.66	IA	an britting a strengt profile
		The sum of errors for model fitted by $B(10, 0.0)$ is		
		$E_2 = 74 - 74.13 + 20 - 25.80 + 14 - 14.51 + 8 - 4.84 + 4 - 0.75 $	14	Accept 12.88
		= 12.87	1	
		Since $E_1 < E_2$, PO(0) his the observed data better.	-	0.000
			(10)	
	~	D(have been concentral diceases)	ad of pass	alata (88 mili) - Provinsi - Prov
(b)	(1)	$= 0.45 \times 0.025 + 0.55 \times 0.01$		19.49
		= 0.01675	1A	Accept 0.0168
	(ii)	P(a baby is born to a non-local mother the baby has congenital diseases) 0.55×0.01		nerve half, derit o
		$=\frac{0.0573017}{0.01675}$	a di ^t icten i	(-0)
		22	1A	OR 0.3284
		= 67	and a line	
	(iii	P(7 babies are born to non-local mothers 8 to 10 babies have congenital diseases)		a second
	(III)	$\frac{e^{-6}6^8}{8!}C_7^8\left(\frac{22}{67}\right)^7\left(\frac{45}{67}\right) + \frac{e^{-6}6^9}{9!}C_7^9\left(\frac{22}{67}\right)^7\left(\frac{45}{67}\right)^2 + \frac{e^{-6}6^{10}}{10!}C_7^{10}\left(\frac{22}{67}\right)^7\left(\frac{45}{67}\right)^2$	$)^{3}$ 1M+1M	1M for numerator
		$= \frac{e^{-6}6^8}{e^{-6}6^9} e^{-6}6^{10}$		1M for denominator
				1 12951 N 1- 10 1- 10 1-
		≈ 0.0061		\$10HA.0-H
			(5)	1

-			Solution	Marks	Remarks
12.	(a)	(i)	P(the centre needs to give out 2 or 3 coupons)		La lite to te tri
			$= P(10 \text{ or } 11 \text{ customers show up})$ $= 12(2)^{10}(1)^2 = 2^{12}(2)^{11}(1)$	1M	성의 공격을 잡지 않을
			$=C_{10}^{12}\left(\frac{-}{3}\right)\left(\frac{-}{3}\right)+C_{11}^{11}\left(\frac{-}{3}\right)\left(\frac{-}{3}\right)$	IIVI	i wa kalimi
			$=\frac{10240}{59049}$	1A	OR 0.1734
		(1)	D(1-36	
		(11)	= P(at most 8 customer show up)	12 64	aw probably a
			$=1-C_9^{12}\left(\frac{2}{3}\right)^9\left(\frac{1}{3}\right)^3-C_{10}^{12}\left(\frac{2}{3}\right)^{10}\left(\frac{1}{3}\right)^2-C_{11}^{12}\left(\frac{2}{3}\right)^{11}\left(\frac{1}{3}\right)-\left(\frac{2}{3}\right)^{12}$	1M	NOTE OF A
			$=\frac{107515}{10000000000000000000000000000000000$	1A	OR 0.6069
			177147	(4)	(00) = 0.6 + 0.6
	(b)	If th	e centre accepts 10 bookings, then (erv customer who have made a booking can be assigned a trainer)	200.01 × 4	
		1 (0	$(10^{2})^{9}(1)(2)^{10}$	1.49.400	
		=1	$-C_{9}\left(\overline{3}\right)\left(\overline{3}\right)-\left(\overline{3}\right)$	14	(0.0) ¹ [3+5
		≈0 >0	8960	11.0 × 0	1 4(a.o) - 5
		If th	e centre accepts 11 bookings, then	and and to a	where all set the
		1 (0	$C_{11}^{11}(2)^{9}(1)^{2} C_{11}^{11}(2)^{10}(1)(2)^{11}$	megaalisti j	CHILD THE STATE
		=1	$-C_9\left(\frac{1}{3}\right)\left(\frac{1}{3}\right) - C_{10}\left(\frac{1}{3}\right)\left(\frac{1}{3}\right) - \left(\frac{1}{3}\right)$	14	o la manifi
		≈ 0 < 0	.7659 .8		Stelling A
,		Her	ace the centre can accepts 10 bookings at most.	IA	80 Ci +
				(3)	
	(c)	(i)	The expected income in that evening	1M	
			$= \$ (0.5 \times 3800 + 0.3 \times 2800 + 0.2 \times 1800) \times 8$ = \$24800	1A	
		(ii)	P(the 8th customer is the first one to select Jade programs) = $(0.8)^7 (0.2)$	a fan i see	(a) (b) (b) (c)
			$=\frac{16384}{1000}$	1A	OR 0.0419
			390625		at at used and
		(iii	P(all programs are selected and exactly 3 are Diamond programs)		
			$=\frac{6!}{3!4!1!}(0.5)^3(0.3)^4(0.2)^1+\frac{6!}{3!3!2!}(0.5)^3(0.3)^3(0.2)^2$		OR $C_3^8 (0.5)^3 [(0.5)^5 - (0.3)^5 - (0.2)^5]$
			$+\frac{8!}{3!2!3!}(0.5)^3(0.3)^2(0.2)^3+\frac{8!}{3!1!4!}(0.5)^3(0.3)^1(0.2)^4$	1M+1A	10
			= 0.1995	1A	Foundation (iii)
		(iv) The required probability		OR
			$=\frac{1}{21205}\left[\frac{8!}{21411}(0.5)^3(0.3)^4(0.2)^1 + \frac{8!}{212121}(0.5)^3(0.3)^3(0.2)^2\right]$	⁶ 1M	$\frac{C_3^8(0.5)^3[C_1^5(0.3)^4(0.2) + C_3^5(0.3)^3(0.2)^2}{0.1005}$
			0.1995[3:4:1: 5:5:2:] ≈ 0.6632	1A	0.1995
				(8)	4
					-