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Uses of Calculators

fx-50FH, fx-50FH II and fx-3650P II are three popular models of scientific calculators among HKDSE candidates. The following provides some tips on using these models of calculators that help candidates increase effectiveness in answering questions.

Command for Calculator Programs

Command	Keys
⌋	a b/c
?	SHIFT 3 1
→	SHIFT 3 2
:	SHIFT 3 3 (or EXE)
◢	SHIFT 3 4
$^{-1}$	x^{-1}
!	SHIFT x^{-1}
nCr	SHIFT ÷
ClrMemory	SHIFT 9 1
M+	M+
⇒	SHIFT 3 ▶ 1
=	SHIFT 3 ▶ 2
≠	SHIFT 3 ▶ 3
>	SHIFT 3 ▶ ▶ 1
<	SHIFT 3 ▶ ▶ 2
≥	SHIFT 3 ▶ ▶ 3
≤	SHIFT 3 ▶ ▶ 4
While	SHIFT 3 ▶ ▶ ▶ ▶ 1
WhileEnd	SHIFT 3 ▶ ▶ ▶ ▶ 2
π^r	SHIFT EXP SHIFT ANS 2
E	EXP
A	ALPHA (–) (or RCL (–))
B	ALPHA ° ’ ” (or RCL ° ’ ”)
C	ALPHA hyp (or RCL hyp)
D	ALPHA sin (or RCL sin)
X	ALPHA) (or RCL))
Y	ALPHA , (or RCL ,)
M	ALPHA M+ (or RCL M+)

Remarks:

1. ▶ is the right arrow key on the REPLAY button (at the centre just below the screen).
2. A, B, C, D, X, Y, M are 7 memory spaces for storing any calculation result. They can also be used in COMP mode.
   - When storing result, press ANS SHIFT RCL (–) (or ° ’ ”, etc.) after pressing EXE.
   - To display the stored value, press ALPHA (–) (or ° ’ ”, etc.) EXE.
   - To use the stored value in the upcoming calculation, press ALPHA (–) (or ° ’ ”, etc.) when inputting the expression.

Useful Calculator Programs

The following provides some useful calculator programs. Candidates may use the programs to calculate or verify their answers quickly.

Remarks: When executing the calculator programs provided, all the values stored in the 7 memory spaces will be cleared (set to zero).

1. Binomial coefficient

The program will calculate the coefficients of the expansion of $(a + bx)^n$ in the ascending powers of x up to the x^k term.

Program Editing

1. Press MODE MODE 6 1 (Edit Program Mode).
2. Press 1, 2, 3 or 4 to select P1, P2, P3 or P4, then press 1.
3. Input the program:

   ClrMemory : ? → A : ? → B : ? → C : ? → D :

   While M ≤ D : C nCr M × A^(C – M) B^(M ◢ 1 M+ : WhileEnd
4. Press MODE 1.

Program Execution

Example: Expand $(–3 + 2x)^7$ in ascending powers of x, up to the x^4 term.

1. Press Prog 1 (or 2, 3, 4 depending on where the program stored).
2. Press –3 EXE 2 EXE 7 EXE 4 EXE to input the binomial and the highest power of x required in the expansion.
3. The screen will display –2187. Press EXE successively, the screen will display 10206, –20412, 22680, –15120 and 0 one by one.
4. Therefore, $(–3 + 2x)^7 = –2187 + 10206x – 20412x^2 + 22680x^3 – 15120x^4$ + terms with higher powers of x.

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MATHEMATICS Extended Part Module 1 (Calculus and Statistics)

Mock Exam 1
Question-Answer Book

(2½ hours)
This paper must be answered in English

Please stick the barcode label here.

Candidate Number									

INSTRUCTIONS

(1) After the announcement of the start of the examination, you should first write your Candidate Number in the space provided on Page 1 and stick barcode labels in the spaces provided on Pages 1, 3, 5, 7, 9 and 11.

(2) This paper consists of TWO sections, A and B.

(3) Attempt ALL questions in this paper. Write your answers in the spaces provided in this Question-Answer Book. Do not write in the margins. Answers written in the margins will not be marked.

(4) Graph paper and supplementary answer sheets will be supplied on request. Write your Candidate Number, mark the question number box and stick a barcode label on each sheet, and fasten them with string INSIDE this book.

(5) Unless otherwise specified, all working must be clearly shown.

(6) Unless otherwise specified, numerical answers must be either exact or given to 4 decimal places.

(7) No extra time will be given to candidates for sticking on the barcode labels or filling in the question number boxes after the 'Time is up' announcement.

	Marker's Use Only	**Examiner's Use Only**
Question No.	Marks	Marks
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
Total		

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Section A (50 marks)

1. Let $y = x^k e^x$, where k is a constant.

(a) Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ in terms of k.

(b) If $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y - (4 - k)x^{k-2}e^x = 0$, find k.

(4 marks)

Answers written in the margins will not be marked.

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9. In an experiment, let K °C be the temperature inside a vessel. The rate of change of K can be modelled by

$$\frac{\mathrm{d}K}{\mathrm{d}t} = \frac{26t(10-t)e^{-\frac{1}{5}t}}{25\left(1+2t^2e^{-\frac{1}{5}t}\right)},$$

where t (in minutes) is the time elapsed since the start of the experiment. The temperature inside the vessel is 20 °C when $t = 0$.

(a) (i) Let $u = 1 + 2t^2e^{-\frac{1}{5}t}$. Find $\frac{\mathrm{d}u}{\mathrm{d}t}$.

(ii) Hence, express K in terms of t.

(b) Someone claims that the temperature inside the vessel cannot exceed 25.5°C. Do you agree? Explain your answer.

(8 marks)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

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Mock Exam 3

Section A

1. **(a)** $P(X = 0) + P(X = 1) + P(X = 2) = 1$

$$\therefore \frac{k^2C_0^2}{2^2} + \frac{k^2C_1^2}{2^3} + \frac{k^2C_2^2}{2^4} = 1 \qquad \text{1M}$$

$$k^2\left(\frac{1}{4} + \frac{1}{4} + \frac{1}{16}\right) = 1$$

$$k = \frac{4}{3} \qquad \text{1A}$$

(b) $P(X = x) = \dfrac{4C_x^2}{9(2^x)}$

$$\therefore E(\bar{X}) = E(X)$$

$$= 0\left[\frac{4C_0^2}{9(2^0)}\right] + 1\left[\frac{4C_1^2}{9(2)}\right] + 2\left[\frac{4C_2^2}{9(2^2)}\right] \qquad \text{1M}$$

$$= \frac{2}{3} \qquad \text{1A}$$

$$E(X^2) = (0^2)\left[\frac{4C_0^2}{9(2^0)}\right] + (1^2)\left[\frac{4C_1^2}{9(2)}\right] + (2^2)\left[\frac{4C_2^2}{9(2^2)}\right]$$

$$= \frac{8}{9} \qquad \text{1A}$$

$$\text{Var}(\bar{X}) = \frac{\text{Var}(X)}{100}$$

$$= \frac{1}{100}\left[\frac{8}{9} - \left(\frac{2}{3}\right)^2\right] \qquad \text{1M}$$

$$= \frac{1}{225} \qquad \text{1A}$$

Guidelines

For n independent random observations of X,

$E(\bar{X}) = E(X)$ and $\text{Var}(\bar{X}) = \dfrac{\text{Var}(X)}{n}$.

2. **(a)** $X \sim \text{Po}(2.5)$

$$\therefore P(X = 3) = \frac{e^{-2.5}(2.5^3)}{3!}$$

$$\approx 0.2138 \text{ (cor. to 4 d.p.)} \qquad \text{1A}$$

(b) $P(X < 2) = \dfrac{e^{-2.5}(2.5^0)}{0!} + \dfrac{e^{-2.5}(2.5^1)}{1!}$ 1M

$$= 3.5e^{-2.5}$$

$$\approx 0.2873 \text{ (cor. to 4 d.p.)} \qquad \text{1A}$$

(c) $P(X < 3) = P(X < 2) + \dfrac{e^{-2.5}(2.5^2)}{2!}$ 1M

$$\approx 0.543813115 < 0.6$$

$$P(X < 4) = P(X < 3) + \frac{e^{-2.5}(2.5^3)}{3!}$$

$$\approx 0.757576133 > 0.6$$

$\therefore$ The greatest value of $n = 3$ 1A

3. **(a)** Sample mean $= \dfrac{21.54 + 25.46}{2}$

$$= 23.5 \text{ minutes} \qquad \text{1A}$$

Let s minutes be the sample standard deviation.

$$2(1.96)\left(\frac{s}{\sqrt{36}}\right) = 25.46 - 21.54 \qquad \text{1M}$$

$$s = 6 \qquad \text{1A}$$

(b) Combined mean $= \dfrac{23.5(36) + 24(44)}{36 + 44}$

$$= 23.775 \text{ minutes}$$

Let x_i and y_i be the ith data in the first batch and the second batch of samples respectively.

$$6 = \sqrt{\frac{1}{36 - 1}\left[\sum_{i=1}^{36} x_i^2 - (36)(23.5^2)\right]} \qquad \text{1M}$$

$$\sum_{i=1}^{36} x_i^2 = 21141$$

$$5 = \sqrt{\frac{1}{44 - 1}\left[\sum_{i=1}^{44} y_i^2 - (44)(24^2)\right]}$$

$$\sum_{i=1}^{44} y_i^2 = 26419$$

Combined sample standard deviation

$$= \sqrt{\frac{1}{80 - 1}\left[\sum_{i=1}^{36} x_i^2 + \sum_{i=1}^{44} y_i^2 - (80)(23.775)^2\right]}$$

$$= \sqrt{\frac{1}{79}\left[21141 + 26419 - (80)(23.775)^2\right]} \qquad \text{1M}$$

$$\approx 5.442391042 \text{ minutes}$$

90% confidence interval for μ

$$\approx \left(23.775 - 1.645\left(\frac{5.442391042}{\sqrt{80}}\right),\right.$$

$$\left. 23.775 + 1.645\left(\frac{5.442391042}{\sqrt{80}}\right)\right)$$

$$\approx (22.7741, 24.7759) \text{ (cor. to 4 d.p.)} \qquad \text{1A}$$