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2016 HKDSE Mathematics Core Paper 2 Suggested Solutions

Prepared by Andy Lai 

HKDSE 5☆☆ Mathematics Teacher

(100% M.C. Right!)

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2016 HKDSE Mathematics Paper 2 Suggested Answers

1.	A	2.	A	3.	D	4.	C	5.	A
6.	B	7.	A	8.	C	9.	D	10.	C
11.	D	12.	D	13.	A	14.	C	15.	B
16.	D	17.	A	18.	C	19.	A	20.	C
21.	B	22.	D	23.	A	24.	B	25.	D
26.	B	27.	C	28.	C	29.	B	30.	B
31.	C	32.	D	33.	A	34.	B	35.	D
36.	B	37.	A	38.	B	39.	A	40.	D
41.	C	42.	A	43.	D	44.	B	45.	C

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5** : 43 / 45 5* : 40 / 45 5 : 38 / 45


4 : 34 / 46 3 : 30 / 45 2 : 26 / 45





Section A


1.	A	<p>黎 Sir 提提你 :</p> <ul style="list-style-type: none"> $8^{222} \cdot 5^{666} = (2^3)^{222} \cdot 5^{666} = 2^{666} \cdot 5^{666} = (2 \times 5)^{666} = 10^{666}$
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2.	A	<p>黎 Sir 提提你 :</p> <ul style="list-style-type: none"> $\frac{a}{x} + \frac{b}{y} = 3 \Rightarrow \frac{a}{x} = 3 - \frac{b}{y} \Rightarrow \frac{a}{x} = \frac{3y - b}{y} \Rightarrow \frac{x}{a} = \frac{y}{3y - b} \Rightarrow x = \frac{ay}{3y - b}$
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3.	D	<p>黎 Sir 提提你 :</p> <ul style="list-style-type: none"> $16 - (2x - 3y)^2$ $= 4^2 - (2x - 3y)^2$ $= [4 - (2x - 3y)][4 + (2x - 3y)]$ $= (4 - 2x + 3y)(4 + 2x - 3y)$
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4.	C	<p>黎 Sir 提提你 :</p> <ul style="list-style-type: none"> $0.0765403 = 0.077$ (correct to 2 sig. fig.) $0.0765403 = 0.077$ (correct to 3 decimal places) $0.0765403 = 0.07654$ (correct to 4 sig. fig.) $0.0765403 = 0.07654$ (correct to 5 decimal places)
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5.	A	<p>黎 Sir 提提你 :</p> <ul style="list-style-type: none"> $\begin{cases} 4\alpha + \beta = 5 \\ 7\alpha + 3\beta = 5 \end{cases} \Rightarrow \begin{cases} 28\alpha + 7\beta = 35 \\ 28\alpha + 12\beta = 20 \end{cases} \Rightarrow 5\beta = -15 \Rightarrow \beta = -3$ $\beta = -3 \Rightarrow \alpha = \frac{5 + 3}{4} \Rightarrow \alpha = 2$
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6.	B	<p>黎 Sir 提提你  :</p> <ul style="list-style-type: none"> • $f(x) = 4x^3 + kx + 3$ is divisible by $2x+1 \Rightarrow f(-\frac{1}{2}) = 0$ • $f(-\frac{1}{2}) = 0 \Rightarrow 4(-\frac{1}{2})^3 + k(-\frac{1}{2}) + 3 = 0 \Rightarrow k = 5$ • When $f(x) = 4x^3 + 5x + 3$ is divided by $x+1$ \Rightarrow Remainder = $f(-1) = 4(-1)^3 + 5(-1) + 3 = -4 - 5 + 3 = -6$
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7.	A	<p>黎 Sir 提提你  :</p> <ul style="list-style-type: none"> • $-5x > 21 - 2x$ and $6x - 18 < 0$ • $-21 > 3x$ and $x < \frac{18}{6}$ • $\frac{-21}{3} > x$ and $x < 3$ • $x < -7$ and $x < 3$ • $\therefore x < -7$
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8.	C	<p>黎 Sir 提提你  :</p> <ul style="list-style-type: none"> • $x^2 + kx + 8k + 36 = 0$ has equal roots $\Rightarrow \Delta = 0$ • $k^2 - 4(1)(8k + 36) = 0 \Rightarrow k^2 - 32k - 144 = 0 \Rightarrow (k + 4)(k - 36) = 0$ • $(k + 4)(k - 36) = 0 \Rightarrow k + 4 = 0$ and $k - 36 = 0 \Rightarrow k = -4$ or $k = 36$
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9.	D	<p>黎 Sir 提提你  :</p> <ul style="list-style-type: none"> • For $-1 < a < 0$, $y = (ax+1)^2 + a$ • Let $a = -0.5 \Rightarrow y = (-0.5x+1)^2 - 0.5 \Rightarrow$ Vertex = $(2, -0.5)$ • y-intercept = $y = (-0.5(0)+1)^2 - 0.5 \Rightarrow$ y-intercept = 0.5 • $y = (ax+1)^2 + a \Rightarrow y = a^2x^2 + 2ax + 1 + a$ • Coefficient of $x^2 = a^2 > 0 \Rightarrow$ Opening upwards! • Therefore, Only the Graph of option D is the answer
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10.	C	<p>黎 Sir 提提你  :</p> <ul style="list-style-type: none"> Let x be the monthly salary of Teresa $33360 = 1.25(0.75)x \Rightarrow x = 35584$
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11.	D	<p>黎 Sir 提提你  :</p> <ul style="list-style-type: none"> $(3y - 4x) : (2 + y) = 5 : 6 \Rightarrow \frac{3y - 4x}{2x + y} = \frac{5}{6} \Rightarrow 18y - 24x = 10x + 5y$ $\frac{x}{y} = \frac{13}{34} \Rightarrow x : y = 13 : 34$
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12.	D	<p>黎 Sir 提提你  :</p> <ul style="list-style-type: none"> $z = \frac{k\sqrt{x}}{y} \Rightarrow z = \frac{k\sqrt{0.64x}}{1.6y} \Rightarrow z = \frac{k\sqrt{x}}{y} \left(\frac{0.8}{1.6}\right) \Rightarrow z = \frac{k\sqrt{x}}{y} (0.5)$ $\therefore z$ is decreased by 50%
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13.	A	<p>黎 Sir 提提你  :</p> <ul style="list-style-type: none"> $\frac{36 \times (2 + 3) - 42 \times 3}{5} = 27 \Rightarrow \\$ 27 / \text{kg}$
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14.	C	<p>黎 Sir 提提你  :</p> <ul style="list-style-type: none"> 1st term = 9, Common difference = 5 7th term = $9 + (7 - 1)(5) = 39$
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15.	B	<p>黎 Sir 提提你  :</p> <ul style="list-style-type: none"> ● $b = c + (180^\circ - 1) \Rightarrow a + b - c = 180^\circ \Rightarrow$ Option II is correct ● If $a = 80^\circ$ and $c = 120^\circ \Rightarrow a + c = 200^\circ \neq 180^\circ \Rightarrow$ Option I is wrong ● If $b = 250^\circ$ and $c = 120^\circ \Rightarrow b + c = 370^\circ \neq 360^\circ \Rightarrow$ Option III is wrong
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16.	D	<p>黎 Sir 提提你  :</p> <ul style="list-style-type: none"> ● In $\triangle ABD$, $24^2 + 32^2 = 1600 = 40^2 \Rightarrow \angle ABD = 90^\circ \Rightarrow \angle CBD = 90^\circ$ ● In $\triangle CBD$, $BC = \sqrt{68^2 - 32^2} = 60$ cm
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17.	A	<p>黎 Sir 提提你  :</p> <ul style="list-style-type: none"> ● $\angle ADC = 114^\circ \Rightarrow \angle BCD = 180^\circ - 114^\circ = 66^\circ$ ● $\angle EBC = 66^\circ \Rightarrow \angle ABE = 114^\circ - \angle EBC \Rightarrow \angle ABE = 48^\circ$
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18.	C	<p>黎 Sir 提提你  :</p> <ul style="list-style-type: none"> ● $l = \sqrt{13^2 - 5^2} = 12 \Rightarrow V = \frac{(4 + 4 + 12)(5)(6)}{2} = 300$ cm³
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19.	A	<p>黎 Sir 提提你  :</p> <ul style="list-style-type: none"> ● <i>Let the angle of the sector OAB be θ</i> ● $\pi(39^2)\left(\frac{\theta}{360^\circ}\right) - \pi(33^2)\left(\frac{\theta}{360^\circ}\right) = 72\pi \Rightarrow \theta = 60^\circ$ ● Area of sector OAB = $\pi(33^2)\left(\frac{60^\circ}{360^\circ}\right) = 181.5\pi$ cm² ● Perimeter of the sector OCD = $13\pi + 39 \times 2 = 13\pi + 78$ cm
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20.	C	<p>黎 Sir 提提你  :</p> <ul style="list-style-type: none"> $A_1 : A_2 : A_3 = 1^2 : 2^2 : 3^2 \Rightarrow A_1 : A_2 : A_3 = 1 : 4 : 9$ Area of $\triangle ADP$: Area of Quad. DEQP : Area of Quad. EHGQ = A : 3A : 5A Area of Quad. DEQP : Area of Quad. APCB = 3A : 5A = 3:5
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21.	B	<p>黎 Sir 提提你  :</p> <ul style="list-style-type: none"> $\frac{x}{AB} = \cos a$ and $\frac{y}{BC} = \sin c$ $x = AB \cos a$ and $y = BC \sin c$ $AD = AB \cos a + BC \sin c$
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22.	D	<p>黎 Sir 提提你  :</p> <ul style="list-style-type: none"> $\angle ADC = 118^\circ \Rightarrow \angle DAB = 180^\circ - 118^\circ = 62^\circ$ (prop. of rhombus) $\angle DAB = 62^\circ \Rightarrow \angle DCB = 62^\circ$ (prop. of rhombus) $\angle DCB = 62^\circ \Rightarrow \angle DEB = 31^\circ$ (\angle at centre twice \angle at circumference) $\therefore \angle DFE = 180^\circ - 62^\circ - 31^\circ \Rightarrow \angle DFE = 87^\circ$ (\angle sum of triangle)
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23.	A	<p>黎 Sir 提提你  :</p> <ul style="list-style-type: none"> Proof by inspection! \Rightarrow Axes of reflectional symmetry = 2
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24.	B	<p>黎 Sir 提提你  :</p> <ul style="list-style-type: none"> $(n-2) \times 180^\circ = 3240^\circ \Rightarrow n = 20$ Each interior $\angle = \frac{3240^\circ}{20} = 162^\circ \Rightarrow$ Each exterior $\angle = 180 - 162^\circ = 18^\circ$ Number of diagonals = $20/2 = 10$
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25. D

黎 Sir 提提你 :


- $hx + ky + 15 = 0 \Rightarrow y = -\frac{h}{k}x - \frac{15}{k}$ and $4x + 3y - 5 = 0 \Rightarrow y = -\frac{4}{3}x + \frac{5}{3}$
- Two straight lines \perp each other $\Rightarrow -\frac{h}{k} \times -\frac{4}{3} = -1 \Rightarrow h = -\frac{3k}{4}$
- Intersection at a point on the x-axis $\Rightarrow 0 = -\frac{h}{k}x - \frac{15}{k} \Rightarrow x = -\frac{15}{h}$
- Intersection at a point on the x-axis $\Rightarrow 0 = -\frac{4}{3}x + \frac{5}{3} \Rightarrow x = \frac{5}{4}$
- Therefore, $-\frac{15}{h} = \frac{5}{4} \Rightarrow h = -12 \Rightarrow -12 = -\frac{3k}{4} \Rightarrow k = 16$

26. B

黎 Sir 提提你 :


- Let the co-ordinates of C be $(2y, y)$
- $AC = BC \Rightarrow (9 - 2y)^2 + (-2 - y)^2 = (-1 - 2y)^2 + (8 - y)^2 \Rightarrow y = 1$
- Therefore, x-coordinate of C = $2(1) = 2$


27. C

黎 Sir 提提你 :

- $3x^2 + 3y^2 - 12x + 30y + 65 = 0 \Rightarrow x^2 + y^2 - 4x + 10y + \frac{65}{3} = 0$
- Therefore, Center $(-\frac{-4}{2}, -\frac{10}{2}) = (2, -5)$
- Radius = $\sqrt{2^2 + (-5)^2 - (\frac{65}{3})} = \sqrt{\frac{22}{3}} \approx 2.708\dots$
- Distance between the Origin and the center
 $= \sqrt{(2-0)^2 + (-5-0)^2} = \sqrt{29} \approx 5.385\dots > 2.708\dots = \text{Radius}$

28.	C	黎 Sir 提提你  : <ul style="list-style-type: none">$\frac{3}{C_3^4} = \frac{3}{4}$
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29.	B	黎 Sir 提提你  : <ul style="list-style-type: none">Expected numbers of tokens = $90 \times \frac{1}{10} + 20 \times \frac{3}{10} + 10 \times \frac{6}{10} = 21$
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30.	B	黎 Sir 提提你  : <ul style="list-style-type: none">Modes = 68 \Rightarrow There are at least three 68 in the sequence.$32 + 68 + 79 + 86 + 88 + 98 + 98 + 68 + 68 + c = 77 \times 10 \Rightarrow c = 85$Arranged in ascending order: 32, 68, 68, 68, 79, 85, 86, 88, 98, 98Median = (79 + 85) / 2 = 82
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Section B

31.

C

黎 Sir 提提你 :

- $9a^2b = (3)(3)a^2b$ and $12a^4b^3 = (2)(2)(3)a^4b^3$ and $15a^6 = 3(5)a^6$
- **Therefore, L.C.M. = $(2)(2)(3)(3)(5)a^6b^3 = 180a^6b^3$**

32.

D

黎 Sir 提提你 :


- $\log_9 y = \left(\frac{4}{2}\right)x - 2 \Rightarrow \log_9 y = \frac{1}{2}x - 2$
- $y = ab^x \Rightarrow \log_9 ab^x = \left(\frac{1}{2}\right)x - 2 \Rightarrow x\log_9 b + \log_9 a = \frac{1}{2}x - 2$
- $\begin{cases} \log_9 a = -2 \\ \log_9 b = \frac{1}{2} \end{cases} \Rightarrow \begin{cases} a = 9^{-2} = \frac{1}{81} \\ b = 9^{\frac{1}{2}} = 3 \end{cases}$


33.


A


黎 Sir 提提你 :


- $BC000DE000000_{16} = 11 \times 16^{12} + 12 \times 16^{11} + 13 \times 16^7 + 14 \times 16^6$
- $BC000DE000000_{16} = 11 \times 16 \times 16^{11} + 12 \times 16^{11} + 13 \times 16 \times 16^6 + 14 \times 16^6$
- $BC000DE000000_{16} = 188 \times 16^{11} + 222 \times 16^6$


34.	B	<p>黎 Sir 提提你  :</p> <ul style="list-style-type: none"> • $uv = \frac{7}{a+i} \times \frac{7}{a-i} = \frac{49}{a^2-i^2} = \frac{49}{a^2+1}$ if $a = \pi \Rightarrow uv = \frac{49}{\pi^2+1}$ is not rational • $u = \frac{7}{a+i} \times \frac{a-i}{a-i} = \frac{7a}{a^2+1} - \frac{7}{a^2+1}i$ and $v = \frac{7}{a-i} \times \frac{a+i}{a+i} = \frac{7a}{a^2+1} + \frac{7}{a^2+1}i$ • Therefore, the real parts of u and v are the same. • $\frac{1}{u} = \frac{a+i}{7} = \frac{a}{7} + \frac{1}{7}i$ and $\frac{1}{v} = \frac{a-i}{7} = \frac{a}{7} - \frac{1}{7}i$
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35.	3	<p>黎 Sir 提提你  :</p> <ul style="list-style-type: none"> • At S, $7(12) - 5(6) + 3 = 57$ • At R, $7(12) - 5(12) + 3 = 27$ • At Q, $7(6) - 5(18) + 3 = -45$ • At P, $7(6) - 5(9) + 3 = 0$ <p>• Remarks: Actually, by inspection, point S is the only possible answer! Why?</p>
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36.	B	<p>黎 Sir 提提你  :</p> <ul style="list-style-type: none"> • $\begin{cases} a_3 = 21 \\ a_7 = 189 \end{cases} \Rightarrow \begin{cases} ar^2 = 21 \\ ar^6 = 189 \end{cases} \Rightarrow r^4 = 9 \Rightarrow r = \pm\sqrt{3} \Rightarrow a = 7$ • For $r = -\sqrt{3} = -1.732.. < 1$ but $r = +\sqrt{3} = 1.732.. > 1$ • $a_4 = \pm 21\sqrt{3}$ is irrational • Sum of 1st 99 terms = $\frac{7(1 - (\sqrt{3})^{99})}{1 - \sqrt{3}} \approx 3.9633... \times 10^{24}$ for $r = \sqrt{3}$ but • Sum of 1st 99 terms = $\frac{7(1 - (-\sqrt{3})^{99})}{1 - (-\sqrt{3})} \approx 1.0619... \times 10^{24}$ for $r = -\sqrt{3}$
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37.	A	<p>黎 Sir 提提你 :</p> <ul style="list-style-type: none"> ● Cosine graph is inverted $\Rightarrow a < 0$ and Amplitude x 2 $\Rightarrow a = 2$ ● Therefore, a = -2 ● Cos (2x°) \Rightarrow New period = old period / 2 \Rightarrow New period = 180° \Rightarrow b = 90
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38.	B	<p>黎 Sir 提提你 :</p> <ul style="list-style-type: none"> ● $5\sin^2\theta + \sin\theta - 4 = 0 \Rightarrow (5\sin\theta - 4)(\sin\theta + 1) = 0$ ● $5\sin\theta - 4 = 0$ or $\sin\theta + 1 = 0 \Rightarrow \sin\theta = \frac{4}{5}$ or $\sin\theta = -1$ ● For $0^\circ \leq \sin\theta \leq 360^\circ$, There are two values of θ for $\sin\theta = \frac{4}{5}$ ● For $0^\circ \leq \sin\theta \leq 360^\circ$, There are one value of θ for $\sin\theta = -1$ ● Therefore, There are three distinct roots for $5\sin^2\theta + \sin\theta - 4 = 0$
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39.	A	<p>黎 Sir 提提你 :</p> <ul style="list-style-type: none"> ● In ΔABC, ● In ΔPQC, $PQ = \sqrt{9^2 + 10^2} = \sqrt{181}$ ● In ΔPFA, $FP = \sqrt{24^2 + 10^2} = 26$ ● In ΔFHQ, $FQ = \sqrt{15^2 + 20^2} = 25$ ● In ΔPQC, $(\sqrt{181})^2 = 25^2 + 26^2 - 2(25)(26)\cos\angle PFQ \Rightarrow \cos\angle PFQ = \frac{56}{65}$ ● Therefore, $\sin\angle PFQ = \frac{\sqrt{65^2 - 56^2}}{65} = \frac{33}{65}$
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40.	D	<p>黎 Sir 提提你  :</p> <ul style="list-style-type: none"> ● Draw a center O on somewhere on AC $\Rightarrow \angle BOD = 360^\circ - 90^\circ - 90^\circ - 68^\circ$ ● $\angle BOD = 112^\circ \Rightarrow \angle BAD = \frac{112^\circ}{2} = 58^\circ$
41.	C	<p>黎 Sir 提提你  :</p> <ul style="list-style-type: none"> ● By calculator program \Rightarrow P (5.4142..., 4.8284..) and Q (2.5857..., -0.8284..) ● y-coordinates of midpoint of PQ = $(4.8284 + (-0.8284))/2 = 2$ ● Remarks: Do you know which 4 programs are the most useful in HKDSE Mathematics exam?
42.	A	<p>黎 Sir 提提你  :</p> <ul style="list-style-type: none"> ● $\frac{C_2^3 C_2^9 + C_3^3 C_1^9}{C_4^{12}} = \frac{108 + 9}{495} = \frac{13}{55}$
43.	D	<p>黎 Sir 提提你  :</p> <ul style="list-style-type: none"> ● $C_0^{15} C_6^{20} + C_1^{15} C_5^{20} + C_2^{15} C_4^{20} = 38760 + 232560 + 508725 = 780045$
44.		<p>黎 Sir 提提你  :</p> <ul style="list-style-type: none"> ● $\frac{(3y^6)^4}{3y^2} = \frac{3^4 y^{24}}{3y^2} = 27y^{22}$
45.	C	<p>黎 Sir 提提你  :</p> <ul style="list-style-type: none"> ● Variance $\times 4^2 = 49 \times 16 = 784$

The end.



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- ◇ 黎 sir 在中學和大學時代已是一名傑出學生，曾獲取的多項學業上和運動上的獎學金及獎項。
- ◇ 曾代表香港參加國際性運動比賽，取得優異成績，又讀得又玩得，絕不是死讀書的書呆子。
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- ◇ 小組教學 (1-6 人)，導師親身教學；照顧每位學生需要，事半功倍。
- ◇ 精心編制筆記，練習以近 30 年本地和外國公開試題為藍本。
- ◇ 概念理解，取分技巧並重；協助同學盡快掌握答題技巧。
- ◇ 歡迎自由組合小組上課，時間及課程內容編排更有彈性。
- ◇ 詳情請瀏覽以下網址: www.andylai.hk





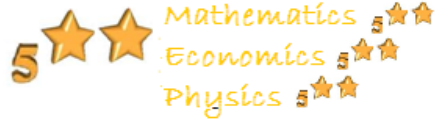
黎 sir 教室 A Lai Learning Center

HKDSE / IB Diploma / GCE AS AL / AP / SAT / HSC

IGCSE / GCSE / IB MYP / KS3 / MO / F.1 – F.6 / Y9 – Y13

資深中學補習導師 小組補習 事半功倍!!!

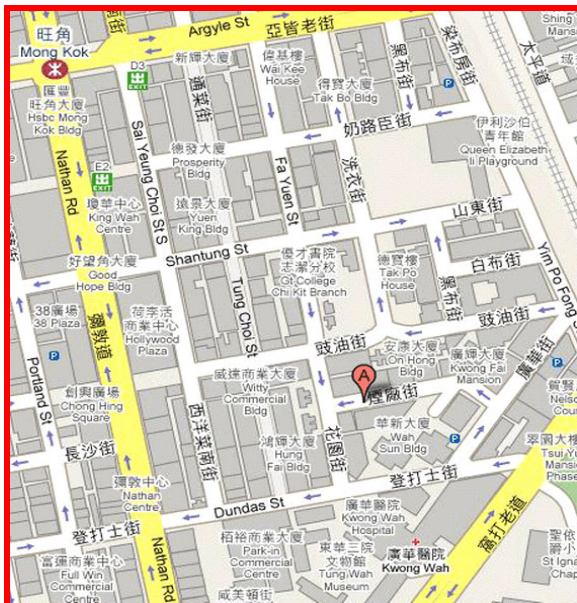
黎 sir 簡介 *Andy Lai* BEng CUHK, MIEEE



- ◇ 畢業於香港中文大學，黎 sir 教室創辦人之一。
- ◇ 超過 16 年教授 中學文憑 / IB Diploma / GCE / HSC / SAT / AP / GCSE / IGCSE / IB MYP 課程經驗。
- ◇ 與學生面對新中學文憑試，黎 sir 親身上陣，於數學科，物理科和經濟科奪取 5**，證明寶刀未老。
- ◇ 現於黎 sir 教室任教補習班，學生就讀於英文中學，中文中學，國際學校及英國留學生。
- ◇ 熟悉近年出題趨勢，教授考試取分技巧；鼓勵同學獨立思考，增強同學理解能力
- ◇ 善用生活化例子講解，教法生動，增加學習趣味；深入淺出，明白學生學習上的困難和需要。
- ◇ 中英對照筆記，適合中文和英文中學學生就讀；精心編制練習和試題，協助同學盡快掌握答題技巧。
- ◇ 黎 sir 在中學和大學時代已是一名傑出學生，曾獲取多項學業上和運動上的獎學金及獎項；曾代表香港參加國際性運動比賽，取得優異成績，「又讀得又玩得」，絕不是死讀書的書呆子。
- ◇ 黎 sir 在就讀大學時曾於全球最大美資電腦公司任實習生超過一年，大學畢業後旋即於全港大型英資電腦公司，負責主理該公司所代理的全球大型美資電腦公司儲存系統銷售業務。
- ◇ 於短短半年內將該產品線銷售業績提升超過 50%。同時更被公司評選為"傑出表現員工 Outstanding Performer"，成功將書本上的知識靈活運用於工作上。
- ◇ 黎 sir 為了教學理想，毅然辭去工作，全身投入教學事業，希望將自己的一套學習方法教授學生

黎 sir 教室 課程特色

- ◇ 小組教學 (1 – 6 人)，導師親身教學；照顧每位學生需要，事半功倍。
- ◇ 精心編制筆記，練習以近 30 年本地和外國公開試題為藍本。
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- ◇ 時間及課程請瀏覽以下網址：www.andylai.hk



- 地鐵： 旺角 E2 出口，油麻地 A2 出口
- 小巴： 1, 1A, 2, 3C, 6, 6C, 6F, 9, 30X, 35A, 41A, 42A, 60X, 63X, 68X, 69X, 81S, 87D, 93K, 95, 104, 117, 203, 212, 230X, 234P, 234X, 238P, 238S, 259B, 270P, 281A
- 小巴： 21K, 74, 74S



黎Sir教室 A Lai Learning Center

- 上課地址： 香港九龍旺角煙廠街 9 號興發商業大廈 706 室。
- 查詢熱線： 6772 3001
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- 網址： www.andylai.hk