

# 2018 GCE O'Level

## Additional Mathematics Paper 1 (4047/01)



### Suggested Answers

<p>1. <math>\sqrt{125^x} = \frac{5 \cdot 5^{-x}}{25}</math></p> $125^{\frac{x}{2}} \cdot 5^x = \frac{1}{5}$ $3125^{\frac{x}{2}} = \frac{1}{5}$ $\frac{x}{2} \ln 3125 = \ln \frac{1}{5}$ $\frac{x}{2} = \frac{\ln \frac{1}{5}}{\ln 3125} = -\frac{1}{5}$ $125^{\frac{x}{2}} = 0.3807 \approx 0.381$	<p>2. (i) <math>\tan C = \tan(180^\circ - (A + B))</math></p> $= \frac{\tan 180^\circ - \tan(A + B)}{1 + (\tan 180^\circ)(\tan(A + B))}$ $= -\tan(A + B)$ <p>(ii) <math>\tan C = -\left[ \frac{\tan 45^\circ + \tan 60^\circ}{1 - \tan 45^\circ \tan 60^\circ} \right]</math></p> $= -\left[ \frac{1 + \sqrt{3}}{1 - \sqrt{3}} \right]$ $\frac{1 + \sqrt{3}}{\sqrt{3} - 1} \times \frac{\sqrt{3} + 1}{\sqrt{3} + 1} = \frac{\sqrt{3} + 1 + 3 + \sqrt{3}}{3 - 1}$ $= \frac{4 + 2\sqrt{3}}{2} = 2 + \sqrt{3}$
<p>3. <math>\frac{7x^2 - 12x + 17}{(2x - 1)(x^2 + 4)} = \frac{A}{2x - 1} + \frac{Bx + C}{x^2 + 4}</math></p> $7x^2 - 12x + 17 = A(x^2 + 4) + (Bx + C)(2x - 1)$ <p>Let <math>x = \frac{1}{2}</math></p> $\frac{7}{4} - 6 + 17 = A\left(\frac{1}{4} + 4\right)$ $A = 3$ <p>Compare coefficient of <math>x^2</math></p> $7 = A + 2B$ $B = 2$ <p>Compare coefficient of <math>x^0</math></p> $17 = 4A - C$ $C = -5$ $\frac{7x^2 - 12x + 17}{(2x - 1)(x^2 + 4)} = \frac{3}{2x - 1} + \frac{2x - 5}{x^2 + 4}$	<p>4. (a) <math>3 + 2\sqrt{5} = \frac{6 + \sqrt{80}}{2}</math></p> $\therefore \frac{-a + \sqrt{a^2 - 4b}}{2} = \frac{6 + \sqrt{80}}{2}$ $a = -6$ $a^2 - 4b = 80$ $b = -11$ <p>(b) Breadth = <math>\frac{24 + \sqrt{48}}{6 + \sqrt{12}}</math></p> $= \frac{12 + 2\sqrt{3}}{3 + \sqrt{3}} \times \frac{3 - \sqrt{3}}{3 - \sqrt{3}}$ $= \frac{30 - 6\sqrt{3}}{6} = 5 - \sqrt{3}$

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### Real Students, Real Testimonials

#### Darren Heng Chen Kai, RJC

“Chu Wei is someone who clearly knows the education and examining system well, and accurately spots questions like a magician (including the actual A level questions).

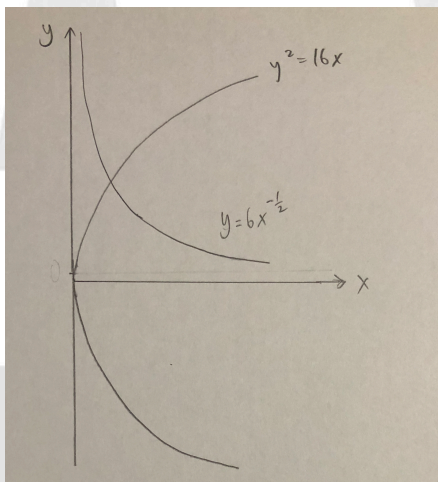


#### Chen Lushi Quinn, VJC

“Chuwei is a tutor with both great knowledge and a big heart. His depth of knowledge of the subject and the syllabus has enabled him to quickly identify his students' weaknesses and advise each of us individually on how we can improve.



5. (i)



(ii)  $y^2 = 16x$        $y = \frac{6}{\sqrt{x}}$

$$\Rightarrow \left(\frac{6}{\sqrt{x}}\right)^2 = 16x$$

$$x^2 = \frac{36}{16}$$

$$x = \frac{3}{2} \quad \text{or} \quad -\frac{3}{2} (\text{rej} \because x > 0)$$

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6. (i)  $\log_3 x + \frac{\log_3 x}{\log_3 9} = \log_3 x + \frac{1}{2} \log_3 x$

$$= \frac{3}{2} \log_3 x$$
$$= \frac{3 \lg x}{2 \lg 3}$$

(ii)  $\frac{3 \lg x}{2 \lg 3} = 4$

$$3 \lg x = 8 \lg 3$$

$$\lg x = \frac{8}{3} \lg 3$$

$$x = 3^{\frac{8}{3}} = 18.72 \approx 18.7$$

7. (i) Volume at  $x = 9$ ,

$$V = \left[ \frac{1}{3} \pi (9^2) \right] [36 - 9] = 729\pi$$

$$\text{Time taken} = \frac{729\pi}{18\pi} = 40.5 \text{ seconds}$$

(ii)  $\frac{dV}{dx} = \left( \frac{2}{3} \pi x \right) (36 - x) + (-1) \left( \frac{1}{3} \pi x^2 \right)$

$$\text{When } x = 9, \quad \frac{dV}{dx} = 135\pi$$

$$\frac{dV}{dt} = \frac{dV}{dx} \times \frac{dx}{dt}$$

$$18\pi = 135\pi \left( \frac{dx}{dt} \right)$$

$$\frac{dx}{dt} = \frac{2}{15} \text{ cm/s}$$

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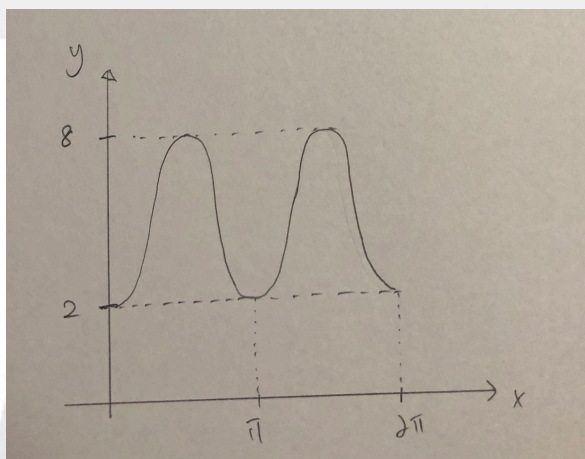
### Suggested Answers

8. (i)  $8\sin^2 x + 2\cos^2 x = 6\sin^2 x + 2\sin^2 x + 2\cos^2 x$   
 $= 3 - 3\cos 2A + 2$   
 $= 5 - 3\cos 2A$

(ii) Amplitude: 3

Period:  $\pi$

(iii)



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9. (i) Gradient of AC =  $\frac{10-0}{0-5} = -2$

Gradient of OB =  $\frac{1}{2}$

∴ OB pass through origin

Equation of OB:  $y = \frac{1}{2}x$

(ii) Let M be the midpoint of OB.

Equation of AC:  $y = -2x + 10$

$$-2x + 10 = \frac{1}{2}x$$

$$x = 4, \quad y = 2$$

$$\therefore M(4, 2)$$

Let point B be  $(x, y)$

$$(4, 2) = \left( \frac{0+x}{2}, \frac{0+y}{2} \right)$$

$$\therefore x = 8, \quad y = 4$$

$$B(8, 4)$$

10. (i) Circumference:  $20 - 3x = 2\pi r$  therefore  $r = \frac{20 - 3x}{2\pi}$

(ii) Total Area:  $\frac{1}{2}x^2 \sin 60^\circ + \pi \left[ \frac{(20 - 3x)}{2\pi} \right]^2 = \frac{\sqrt{3}\pi x^2 + (20 - 3x)^2}{4\pi}$

$$\frac{dA}{dx} = \frac{1}{4\pi} (2\sqrt{3}\pi x + 2(20 - 3x)(-3))$$

when  $\frac{dA}{dx} = 0 \quad x = 4.15$

(iii)  $\frac{d^2A}{dx^2} = \frac{1}{4\pi} (2\sqrt{3}\pi + 18) > 0$

Hence, area is a minimum.

Therefore, gardener will be disappointed.

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11. (i) By long division

$$f'(x) = 5 + \frac{6}{2x-3}$$

(ii)  $x > \frac{3}{2}$

$$2x > 3$$

$$2x - 3 > 0$$

$$\text{then } \frac{6}{2x-3} > 0$$

$$\text{hence } f'(x) = 5 + \frac{6}{2x-3} > 0 \text{ for } x > \frac{3}{2}$$

Therefore  $f(x)$  is an increasing function

(iii)  $f''(x) = -\frac{6}{(2x-3)^2}$

$$\text{Since } (2x-3)^2 > 0 \text{ for all } x$$

$$\text{Then } -\frac{6}{(2x-3)^2} < 0$$

Hence,  $f'(x)$  is a decreasing function.

(iv)  $f(x) = 5x + 6\ln(2x-3) + c, x > \frac{3}{2}$

$$f(2) = 8 \text{ then } c = -2$$

$$f(x) = 5x + 6\ln(2x-3) - 2, x > \frac{3}{2}$$

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12. (i) Since PQ : AR is 1 : 4

By similar triangle:

$$R(8, 0)$$

As graph is symmetrical about  $x = 8$

Then  $x$ -coordinate of S will be  $8+10=18$

Since S lies on  $y = 15$

Then S (18, 15)

- (ii) Let coordinate Q be (0, b)

Then by similar triangle

$$\frac{15-b}{b} = \frac{1}{4}$$

$$b = 12$$

$$\text{Gradient of SR} = a = \frac{15-0}{18-8} = \frac{3}{2}$$

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