



2

i) i) $y = x + 3$

$$\frac{dy}{dx} = 1$$

2

ii) $y = 4x^3 + 10x^{\frac{1}{2}}$

~~$$y = 4x^3 + 10x^{\frac{1}{2}}$$~~

$$y = 4(3x^2) + 10(\frac{1}{2}x^{-\frac{1}{2}})$$

$$\frac{dy}{dx} = 12x^2 + 5x^{-\frac{1}{2}}$$

~~$$\frac{dy}{dx} = 12x^2 + 5x^{-\frac{1}{2}}$$~~

3

iii) $y = \frac{1}{x^5} + x^3$

$$y = \frac{1}{x^5} + 3x^2$$

$$\frac{dy}{dx} = x^{-5} + 3x^2$$

$$\frac{dy}{dx} = -5x^{-6} + 3x^2$$

2

iv) $y = \sin(8x)$

$$\frac{dy}{dx} = 8\cos(8x)$$

2

✓

~~1) a) v)~~

1) a) v) $y = x \cos(x)$

$$y' = (f \times g') + (g \times f')$$

let $x = f$
let $\cos(x) = g$

$$f' = 1$$

$$g' = -\sin(x)$$

$$y' = (-x \sin(x)) + (\cos(x) \times 1)$$

$$y' = \cos(x) - x \sin(x)$$

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vi) vi) $y = (2x - 3)^{10}$

$$y = f(g(x))$$

$$y' = f'(g(x)) \times g'(x)$$

let $f = (g)^{10}$
let $g = 2x - 3$

✓

i) u) vi) continued

$$f' = 40(g)^4$$

$$g' = 2$$

$$y' = 10(2x-3)^4 \times 2$$

$$y' = 20(2x-3)^4$$

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vii) $y = (3x + \tan(x))$

$$y = (3 + \tan(x))$$

$$\frac{dy}{dx} = 3 + \sec^2(x)$$

2



1) b) $y = \frac{1}{x} + \cos(2x)$
 find $\frac{d^3 y}{dx^3}$

Step 1

$$\frac{d^1 y}{dx^1} = \cancel{\ln x} - 2 \sin(2x)$$

Step 2

$$\begin{aligned} \frac{d^2 y}{dx^2} &= \cancel{\frac{1}{x}} - 2(2 \cos(2x)) \\ &= \cancel{\frac{1}{x}} - 4 \cos(2x) \end{aligned}$$

Step 3

$$\begin{aligned} \frac{d^3 y}{dx^3} &= \cancel{\ln(x)} - 4[-2 \sin(2x)] \\ &= \cancel{\ln x} + 8 \sin(2x) \end{aligned}$$

2

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$$\frac{d^3 y}{dx^3} = \ln x + 8 \sin(2x)$$

$$1)c) \quad c) y = \frac{(x-1)}{(4+x^2)} = f$$

$$\frac{dy}{dx} = \frac{(g \times f' - f \times g')}{g^2}$$

~~$$g = (4+x^2)$$~~

$$f' = 1$$

$$g' = 2x$$

$$\frac{dy}{dx} = \frac{(4+x^2)(1) - (x-1)(2x)}{(4+x^2)^2}$$

$$= \frac{4+x^2 - 2x^2 + 2x}{16 + 4x^2 + 4x^2 + x^4}$$

Cancel here

$$= \frac{x^2 + 2x + 4}{8x^2 + x^4 + 16}$$

$$\frac{dy}{dx} = \frac{(x^2 + 2x + 4)}{(x^4 - 8x^2 + 16)}$$

(✓)

✓
(5)

When $x = 0$

$$\frac{0^2 - 2(0) + 4}{8(0)^2 + (0)^4 + 16} = \frac{1}{4} = 0.25$$

$$2) \Rightarrow \int (10x + x^3) dx$$

$$= 10 \frac{x^2}{2} + \frac{x^4}{4} + C$$

$$= 5x^2 + \frac{1}{4}x^4 + C$$

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~~ii) ii)~~

~~$$\int (x - 3e^x) dx$$~~

$$ii) ii) \int (x - 3e^x) dx$$

$$= \frac{x^2}{2} - 3e^x + C$$

3

$$iii) iii) \int \left(\frac{1}{x} + 4 \right) dx$$

$$= \ln(x) + 4x + C$$

3

$$iv) iv) \int 2x(3x+4) dx$$

$$2x(3x+4) = 6x^2 + 8x$$

$$\int (6x^2 + 8x) dx$$

$$= 6 \frac{x^3}{3} + \frac{8x^2}{2}$$

$$= 2x^3 + 4x^2 + C$$

3

$$2/11) \int_0^2 (3x^2 + 2x) dx$$

$$= \left[3 \frac{x^3}{3} + 2 \frac{x^2}{2} \right]_0^2$$

$$= x^3 + x^2$$

$$(2)^3 + (2)^2 - (0)^3 + (0)^2 = \underline{\underline{12}}$$

3



$$3) a) i) \quad 3) a) ii) \quad (3+2i)(1-i)$$

$$= 3 \times 1 - i + 2i - 2i^2$$

$$= \underline{5 + i}$$

$$ii) \quad ii) \quad \frac{3}{(2+i)}$$

$$\frac{3}{(2+i)} \times \frac{(2-i)}{(2-i)} = \frac{3(2-i)}{(2+i)(2-i)}$$

$$(2+i)(2-i) = 4 - 2i + 2i - i^2$$

$$= 4 - (-1)$$

$$= 5$$

$$3(2-i) = 6 - 3i$$

$$\therefore \frac{6-3i}{5} = \frac{6}{5} - \frac{3i}{5} = \underline{\underline{\frac{6}{5} - \frac{3}{5}i}}$$

$$iii) \quad \frac{4}{i5} = \frac{4}{i^2 \times i^2 \times i} = \frac{4}{-1 \times -1 \times i} \checkmark$$

$$\frac{4}{-i} = -4i \quad \checkmark$$

$$\frac{4}{i5} = \underline{\underline{-4i}}$$

3) b) i)

$$z_1 = \frac{2-j}{2+j}, \quad z_2 = \frac{3+j}{3-j}$$

$$z_1 = \frac{(2-j)}{(2+j)} \times \frac{(2-j)}{(2-j)}$$

$$= \frac{(2-j)(2-j)}{(2+j)(2-j)}$$

$$= \frac{4 - 2j - 2j + j^2}{4 - 2j + 2j - j^2} = \frac{4 - 4j + j^2}{4 - j^2}$$

$$= \frac{4 + (-1) - 4j}{4 - (-1)} = \frac{3 - 4j}{5} = \frac{3}{5} - \frac{4}{5}j$$

$$z_1 = \frac{3}{5} - \frac{4}{5}j$$

$$z_2 = \frac{(3+j)}{(3-j)} \times \frac{(3+j)}{(3+j)}$$

$$= \frac{(3+j)(3+j)}{(3-j)(3+j)}$$

$$= \frac{9 + 3j + 3j + j^2}{9 + 3j - 3j - j^2} = \frac{9 + 6j + j^2}{9 - j^2}$$

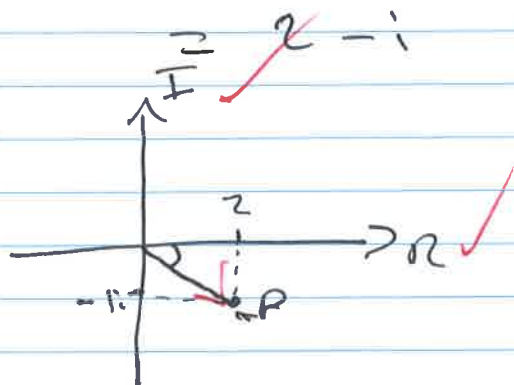
$$= \frac{9 + (-1) + 6j}{9 - (-1)} = \frac{8 + 6j}{10} = \frac{8}{10} + \frac{6}{10}j$$

$$z_2 = \frac{8}{10} + \frac{6}{10}j$$

$$= \frac{4}{5} + \frac{3}{5}j$$

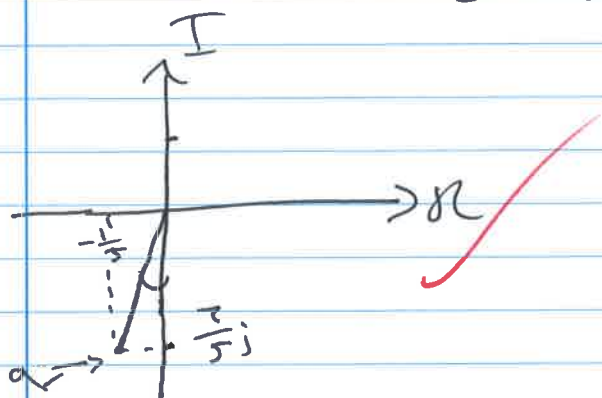
3)c)i) 3)c)i)

$$p = 2\left(\frac{3}{5} - \frac{4}{5}j\right) + \left(\frac{8}{10} + \frac{6}{10}j\right)$$

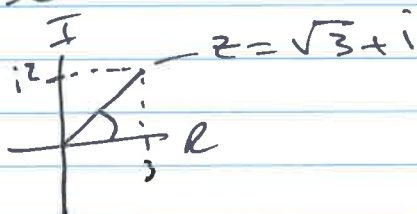


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$$\begin{aligned} \text{ii) } p &= \left(\frac{3}{5} - \frac{4}{5}j\right) - \left(\frac{8}{10} + \frac{6}{10}j\right) \\ &= -\frac{1}{5} - \frac{7}{5}j \end{aligned}$$



SOH CAH



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$$d) z = \sqrt{3} + j$$

$$z = r(\cos(\theta) + j\sin(\theta))$$

$$r = \sqrt{\left(\frac{3}{\sqrt{3}+1}\right)^2 + \left(\frac{1}{\sqrt{3}+1}\right)^2}$$

$$\cos^{-1}\left(\frac{\sqrt{3}+1}{3}\right) = \theta(\cos)$$

$$\sin^{-1}\left(\frac{1}{\sqrt{3}+1}\right) = \theta(\sin)$$

1

$$\log_5 3 = 4 \Rightarrow 5^4 = 3$$

Question No.

Examiner Only

(1a)i) (1a)i) $3^{2x} = 2^{x+1}$

~~$2 \log 2$~~ $2 \log_{x+1} = 3 \log_{2x}$