

$$iv) \quad 2j(j-1) + (\sqrt{5}-j) + (1+j)(\overline{1+j}) \quad ?$$

$$2j(j-1) + (\sqrt{5}-j) + (1+j)(1+j) \quad ?$$

$$a + (b+c) = a+b+c$$

$$2j(j-1) + (\sqrt{5}-j) = 2j(j-1) + \sqrt{5}-j$$

$$= 2j(j-1) + \sqrt{5}-j + (1+j)(1+j)$$

$$aa = a^2$$

$$(1+j)(1+j) = (1+j)^2$$

$$= 2j(j-1) + \sqrt{5}-j + (1+j)^2$$

$$\text{expand } 2j(j-1): \quad 2j^2 - 2j$$

$$= 2j^2 - 2j + \sqrt{5} - j + (1+j)^2$$

$$\text{expand } (1+j)^2: \quad 1 + 2j + j^2$$

$$= 2j^2 - 2j + \sqrt{5} - j + 1 + 2j + j^2$$

$$= 2j^2 + j^2 + \sqrt{5} - 2j - j + 2j + 1$$

$$= 3j^2 + \sqrt{5} - 2j - j + 2j + 1$$

$$= 3j^2 + \sqrt{5} - j + 1$$

MATHS EXAM 2

~~Q1) i)~~
Q1) i) $y = \frac{x^2}{2x+1}$

$$y = -2x^3 - 1$$

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

ii) $y = \sqrt{x^2 + 1}$

$$= x + 1^{\frac{1}{2}}$$

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

iii)

b) GIVEN $y = \frac{1}{x} + \cos 2x$, find $\frac{d^5 y}{dx^5}$

$$= \frac{d^5}{dx^5} (y) \text{ given } y = \frac{1}{x} + \cos(2x)$$

$$= \frac{d}{dx} \left(\frac{1}{x} + \cos(2x) \right) = -\frac{1}{x^2} - \sin(2x) \times 2$$

$$\text{Find value} = -\frac{1}{x^2} - \sin(2x) \times 2 \text{ for}$$

$$-\frac{1}{x^2} - \sin(2x) \times 2$$

$$= \left(-\frac{1}{x^2} - \sin(2x) \times 2 \right)$$

$$Q2) a) i) \int \frac{2x}{(4+3x^2)} dx$$

$$= 2x \int \frac{x}{4+3x^2} dx$$

$$= 2x \int \frac{1}{6u} du$$

$$= \cancel{2x \int \frac{1}{6u} du} \quad 2x \cdot \frac{1}{6} \times \int \frac{1}{u} du$$

$$= 2x \cdot \frac{1}{6} \ln|u|$$

$$= 2x \cdot \frac{1}{6} \ln|u|$$

$$= 2x \cdot \frac{1}{6} \ln|4+3x^2|$$

$$= \frac{1}{3} \ln|4+3x^2|$$

$$= \frac{1}{3} \ln|4+3x^2| + C$$

$$\int_0^4 e^{\frac{1}{2}x} dx$$

$$\int_0^2 e^u \times 2 du$$

$$2 \times \int_0^2 e^u du$$

$$2[e^u]_0^2$$

$$= 2(e^2 - 1)$$

$$\text{iii)} \int_0^4 \frac{5x+13}{(2x+1)(x+4)} dx$$

$$= \frac{5x+13}{(2x+1)(x+4)} = \frac{3}{2x+1} + \frac{1}{x+4}$$

$$= \int_0^4 \frac{3}{2x+1} + \frac{1}{x+4} dx$$

$$\int f(x) \pm g(x) dx = \int f(x) dx \pm \int g(x) dx$$

$$= \int_0^4 \frac{3}{2x+1} dx + \int_0^4 \frac{1}{x+4} dx$$

$$= \int_0^4 \frac{3}{2x+1} dx = 3 \ln(3)$$

$$= \int_0^4 \frac{1}{x+4} dx = \ln(2)$$

$$= 3 \ln(3) + \ln(2)$$

$$Q3) a) i) \left(\frac{1+i}{1-i} \right)^3$$

$$\frac{1+i}{1-i} \cdot i$$

$$= i^3$$

$$a^{b+c} = a^b a^c$$

$$j^3 = j^2 j$$

$$= j^2 j$$

$$j^2 = -1$$

$$= -1 j$$

$$= -j$$

$$\frac{3}{(1+j)(2+j)}$$

$$= \frac{3}{2+3j+j^2}$$

$$\frac{1+j}{1-j} = (1+2j)(2+2j) + \frac{3-j}{1+j}$$

$$= \frac{1+j}{1-j} + \frac{3-j}{1+j} \quad \frac{(1+j)^2 + (3-j)(-j+1)}{(-j+1)(j+1)}$$

$$\frac{(1+j)^2 + (3-j)(-j+1)}{(-j+1)(j+1)} - (1+2j)(2+2j)$$

$$a + \frac{b}{c} = \frac{ac+b}{c}$$

$$= \frac{-(1+2j)(2+2j)(-j+1)(j+1) + (1+j)^2(3-j)(-j+1)}{(-j+1)(j+1)}$$

$$= \frac{4j^4 + 6j^3 - 8j + 2}{(-j+1)(j+1)}$$

$$2j(j-1) + (\sqrt{5} - j) + (1+j)(1+j) \quad \swarrow ?$$

$$2j(j-1) + (\sqrt{5} - j) + (1+j)(1+j) \quad ?$$

$$a + (b+c) = a+b+c$$

$$2j(j-1) + (\sqrt{5} - j) = 2j(j-1) + \sqrt{5} - j$$

$$= 2j(j-1) + \sqrt{5} - j + (1+j)(1+j)$$

$$aa = a^2$$

$$(1+j)(1+j) = (1+j)^2$$

$$= 2j(j-1) + \sqrt{5} - j + (1+j)^2$$

$$\text{expand } 2j(j-1) : 2j^2 - 2j$$

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$$= 2j^2 + j^2 + \sqrt{5} - 2j - j + 2j + 1$$

$$= 3j^2 + \sqrt{5} - 2j - j + 2j + 1$$

$$= 3j^2 + \sqrt{5} - j + 1$$

b) ~~Express following complex number in Polar form~~

~~COMPLEX~~ POLAR FORM $z = (4 + 7j)(3 - 2j)$

b) $z = (4 + 7j)(3 - 2j)$

~~Express in Polar form~~

$$z = a + bj$$

Cartesian (a, b)

Polar (r, θ)

$$r = z = \sqrt{a^2 + b^2} = \sqrt{3^2 + 2^2}$$

$$= 9 + 4$$

$$r = \sqrt{13}$$

FIND THE QUOTIENT OF $1+3j$ and $1+j$

$$1+3j \div 1+j$$

$$1+3j : z^2$$

$$(1+j) \times z^2$$

$$\cancel{4+4j} \quad 4(1+j)$$

$$= 4+4j$$