

Two

a.
i) $\int (x^2 - 6x)(3x^2 - x) \, dx$

$$\int -x^2 + 3x^4 - 18x^3 + 6x^2 \, dx$$

$$\int 3x^4 - 18x^3 + 5x^2 \, dx$$

$$\frac{3x^5}{5} - \frac{18x^3}{3} + \frac{5x^2}{2} + C$$

ii) $\int (x^2 + 3x)^2 + e^{0.5x} - \sin 2x \, dx$

$$(x^2 + 3x)(x^2 + 3x) = x^4 + 6x^3 + 9x^2$$

$$\int x^4 + 9x^2 + 6x^3 + e^{0.5x} - \sin 2x \, dx$$

$$\frac{x^5}{5} + \frac{9x^3}{3} + \frac{6x^4}{4} + 2e^{0.5x} - \frac{1}{2} \cos 2x + C$$

iii) $\int_0^3 (2x^2 + 3)^3 \, dx$

$$(2x^2 + 3)(2x^2 + 3) = 4x^4 + 12x^2 + 9$$

$$\int_0^3 (4x^4 + 12x^2 + 9)(2x^2 + 3) \, dx$$

$$8x^6 + 12x^4 + 24x^4 + 36x^2 + 18x^2 + 27$$

$$8x^6 + 36x^4 + 54x^2 + 27$$

$$\left[8x^6 + 36x^4 + 54x^2 + 27 \right]_0^3 - [0] =$$

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$$\left[\frac{8x^7}{7} + \frac{36x^5}{5} + \frac{54x^3}{3} + 27x \right]_0^3$$

$$= [2499 + 1749.6 + 486 + 81] - [0]$$

$$= \underline{4815.6}$$

iv. $\int_2^5 x^3 + 2x^2 - x + 5 \, dx$

$$\int_2^5 \frac{x^4}{4} + \frac{2x^3}{3} - \frac{x^2}{2} + 5x \, dx$$

$$\left[\frac{x^4}{4} + \frac{2x^3}{3} - \frac{x^2}{2} + 5x \right]_2^5$$

$$(156.25 + 83.34 - 5 + 25) - (4 + 5.34 - 0.8 + 10)$$

$$(259.9) - (18.54)$$

$$\underline{241.36}$$

b. $\int 3x \sin 5x \, dx$

$$uv - \int v \frac{du}{dx} \, dx$$

$\downarrow \quad \downarrow$
 $u \quad dv/dx$

$du/dx = 3 \quad v = -1/5 \cos 5x$

$$-3/5 x \cos 5x + \int 3/5 \cos 5x \, dx$$

$$-3/5 x \cos 5x + 3/5 \sin 5x + C$$

$$\int \underbrace{x}_u \underbrace{\cos x/2}_{dv/dx} dx$$

$$uv - \int v du/dx dx$$

$$du/dx = 1 \quad v = 2 \sin x/2$$

$$2x \sin x/2 - \int 2 \sin x/2$$

$$2x \sin x/2 + 4 \cos x/2 + C$$

$$c) i) \int \frac{15x^2 - 4x}{5x^3 - 2x^2 + 5} dx$$

$$= \ln(5x^3 - 2x^2 + 5) + C$$

$$ii) \int \frac{7}{4x-15} dx$$

$$7 \int \frac{1}{4x-15} dx \rightarrow 1.75 \ln(4x-15) + C$$

$$iii) \int \tan^2 x dx$$

$$\tan(x) - x + C$$

ONE $z_1 = 7+5j$ $z_2 = 3-7j$ $z_3 = -2+6j$

Q) i) $5+11j$

ii) $9-j$

iii) $\frac{7+5j}{3-7j} \times \frac{3+7j}{3+7j} = \frac{21+49j+15j+35j^2}{9+21j-21j-49j^2}$

$\frac{-14+64j}{58}$

$\frac{-14+64j}{9+49}$

$\frac{-14+64j}{58}$

$-\frac{14}{58} + \frac{64}{58}j$

iv) $(7-5j) - (3+7j)$

$4-12j$

v) $(z_1)^2 - z_2 - z_3$

$(7+5j)(7+5j) = 49+35j+35j-25$

$24+70j - (3-7j) - (-2+6j)$

$23+71j$

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b

$$12x^2 + 5x = -13$$

$$12x^2 + 5x + 13 = 0$$

$$x = \frac{-5 \pm \sqrt{(5)^2 - 4 \cdot (12) \cdot (13)}}{2 \cdot 12}$$

$$x = \frac{-5 \pm \sqrt{25 - 624}}{24}$$

$$x = \frac{-5 \pm \sqrt{-599}}{24} \rightarrow x = \frac{-5 \pm \sqrt{24.47}}{24}$$

$$+x = 0.81 \quad -x = -1.23$$

$$-1.23 + 0.81j$$

$$-1.23 - 0.81j$$

$$r = 1.47 \quad \theta = 33.37$$

$$r = 1.47 \quad \theta = 326.63$$

$$1.47(\cos 33.37 + j \sin 33.37)$$

$$1.47(\cos 326.63 + j \sin 326.63)$$

$$c) (4 + 9j)^4$$

$$r^n (\cos n\theta + j \sin n\theta)$$

$$r = \sqrt{5^2 + 9^2} \therefore r = \sqrt{4^2 + 9^2} = 9.85$$

$$\theta = \tan^{-1}(9/4) \therefore \tan^{-1}(9/4) = 66.03$$

$$9.85^4 \times (\cos(4 \times 66.03) + j \sin(4 \times 66.03))$$

$$9413.37 \cdot \cos(264) + j \sin(264)$$

$$9413.37 \sin 264 = j \sin(264)$$

$$= -970.89 - 9363.17j$$

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$$d) j^4 = j^2 \cdot j^2 = -1 \cdot -1 = \textcircled{1}$$