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6/5/2021

2001096

ACHA 4006
Further maths

calvin campbell

1)

i) $y = 7x^3 - 2x^2 + x + 2$
 $\frac{dy}{dx} = 21x^2 - 4x + 1$

ii) $y = (x+3)(x+2)$
 $y = x^2 + 2x + 3x + 6$
 $y = x^2 + 5x + 6$
 $\frac{dy}{dx} = 2x + 5$

iii) $y = \frac{1}{x^3} + \sin 3x$
 $V \frac{du}{dx} + u \frac{dv}{dx}$
 $v = \frac{1}{x^3}$
 $u = \sin 3x$
 $\frac{du}{dx} = \cos 3x$
 $\frac{dv}{dx} = -\frac{3}{x^4}$

$\frac{dy}{dx} = \left(\frac{1}{x^3}\right)(\cos 3x) + (\sin 3x)\left(-\frac{3}{x^4}\right)$
 $\frac{dy}{dx} = \frac{1}{x^3} \cos 3x - \frac{3 \sin 3x}{x^4}$

iv) $y = x^4 \tan 2x$
 $v = x^4$
 $u = \tan 2x$
 $\frac{dv}{dx} = 4x^3$

$\frac{du}{dx} = 2 \sec 2x$

$\frac{dy}{dx} = (x^4)(2 \sec 2x) + (4x^3)(\tan 2x)$

$\frac{dy}{dx} = x^4 2 \sec 2x + 4x^3 \tan 2x$

v) $y = \frac{e^{2x}}{\cos 2x}$

$v = \cos 2x$

$u = e^{2x}$

$\frac{dv}{dx} = -2 \sin 2x$

$\frac{du}{dx} = 2e^{2x}$

$\frac{dy}{dx} = \frac{(\cos 2x)(2e^{2x}) - (e^{2x})(-2 \sin 2x)}{\cos^2 2x}$

vi) $y = (5x^2 + 2x + 1)^5$

$= 10x + 2$

$\frac{dy}{dx} = 5(5x^2 + 2x + 1)^4 (10x + 2)$

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2)

i) $\sin x = 0.65$

$\sin^{-1}(0.65) = 40.54^\circ$

$180 - 40.54 = 139.46^\circ$

ii) $7 \cos x = 4$

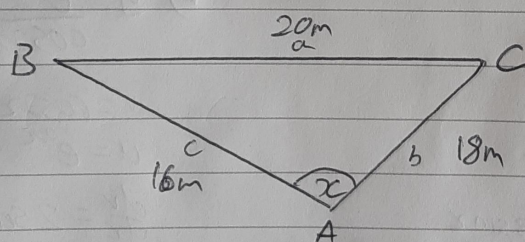
$\cos^{-1}(\frac{4}{7})$

iii) $\tan x = -0.22$

$\tan^{-1}(-0.22) = 12.41$

$180 + 12.41 = 192.41^\circ$

3)



$a^2 = b^2 + c^2 - 2bc \cos A$

$20^2 = (18)^2 + (16)^2 - 2(18)(16) \cos A$

$400 = 324 + 256 - 576 \cos A$

$400 - (324 + 256) = -576 \cos A$

$-180 = -576 \cos A$

$\frac{-180}{-576} = \cos A$

$\cos A = 0.3125$

$\cos^{-1}(0.3125)$

$A = 71.79^\circ$

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4)

$$p = \sqrt{\frac{xy}{T}} + 3$$

$$p^2 = \frac{xy}{T} + 3$$

$$p^2 T = xy + 3$$

$$p^2 T - 3 = xy$$

$$x = \frac{p^2 T - 3}{y}$$

5)

$$i) 5^{x+2} = 2^x$$

$$\log 5^{x+2} = \log 2^x$$

$$(x+2) \log 5 = x \log 2$$

$$ii) \log(x+2) + \log(x+3) = 2 \log(x+1)$$

$$\log(x+2)(x+3) = \log(x+1)^2$$

$$= (x+2)(x+3) = (x+1)(x+1)$$

$$= (x^2 + 3x + 2x + 6) = (x^2 + 2x + 1)$$

$$= 5x + 6 = 2x + 1$$

$$= 3x + 6 = 1$$

$$= 3x = 1 - 6$$

$$= 3x = -5$$

$$x = \frac{-5}{3}$$

$$x = -1.6\bar{6}$$

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Further maths

6)

i) $\int x^4 + 3x^2 - 3x + 1 \, dx$

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

ii) $\int (x-1)(x-3) \, dx$

$$x^2 - 3x - x - 3x$$

$$x^2 - 6x - x$$

$$\int x^2 - 7x$$

$$\int \frac{x^3}{3} - 7x + C$$

iii) $\int 3 \sec^2 2x \, dx$

$$3 \int \frac{1}{2} \tan 2x + C$$

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

$$x^2 + 2x + 3x + 6$$

$$x^2 + 5x + 6$$

$$\left[\frac{x^3}{3} + (5x^2) + 6x \right]_0^4 - \left[\frac{0^3}{3} + (5 \times 0) + 6 \right]_0^0$$

$$\left[\frac{64}{3} + 20 + 24 \right] - \left[6 \right]$$

$$\left[\frac{64}{3} + 20 + 24 \right] - \left[6 \right]$$

$$\left[\frac{64}{3} + 20 + 24 \right] - \left[6 \right]$$

$$= 36$$

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6)

v)

$$\int_2^3 x(x+1) + e^x \, dx$$

$$x^2 + x + e^{2x} \quad \text{Ans: } \frac{1}{4}x^2 + \frac{1}{2}x + \frac{1}{4}e^{2x}$$

$$\left[\frac{x^2}{2} + x + e^x \right]$$

$$\left[\frac{3^2}{2} + 3 + \frac{1}{1} e^3 \right]^3 - \left[\frac{2^2}{2} + 3 + \frac{1}{1} e^2 \right]^2$$

$$\left[\begin{array}{ccc} 7.5 & +3 & +1e^3 \\ & & \end{array} \right] \rightarrow \left[\begin{array}{ccc} 2 & +3 & +1e^2 \\ & & \end{array} \right]$$

$$\left[10s + \frac{1}{s} \right] - \left[s + \frac{1}{s} \right]$$

$$= 5.5 + e$$