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Further Mathematics (ACHA4006)

i) $y = 5x^4 + 5x^2 + 3x - 19$

$$\frac{dy}{dx} = \underline{20x^3 + 10x + 3}$$

ii) $y = (2x + 5)(x - 1)$

$$y = 2x^2 - 2x + 5x - 5$$

$$\frac{dy}{dx} = \underline{4x + 3}$$

iii) $y = \frac{1}{x^6} - \cos 5x$

$$y = x^{-6} - \cos 5x$$

$$\frac{dy}{dx} = \underline{-6x^{-5} + 5 \sin 5x}$$

iv

$$y = e^{2x} \sin 3x = e^{2x} \times \sin 3x$$

$$\frac{dy}{dx} = 2e^{2x} \times 3 \cos 3x = \underline{2e^{2x} 3 \cos 3x}$$

v) $y = \frac{\tan 7x}{\sin x} \quad \frac{dy}{dx} = \frac{7 \sec^2 7x}{\cos x} \leftarrow \text{Answer}$

vi) $y = \sqrt{6x^2 - 3x + 5} = (6x^2 - 3x + 5)^{0.5}$

$$\frac{dy}{dx} = 0.5(6x^2 - 3x + 5)^{-0.5} \times (12x - 3)$$

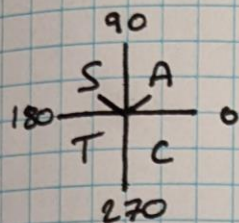
$$\frac{dy}{dx} = (3x^2 - 1.5x + 2.5)^{-0.5} \times (6x - 1.5) \leftarrow \text{Answer}$$

$$\frac{1}{(3x^2 - 1.5x + 2.5)}$$

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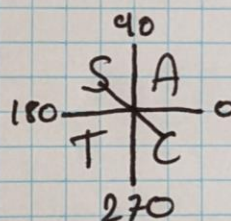
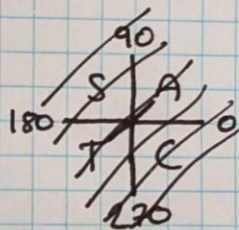
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2) i $\sin x = 0.43$
 $x = \sin^{-1}(0.43)$
 $x = \underline{\underline{25.47 \text{ (2dp)}}}$



$$x = 180 - 25.47 = \underline{\underline{154.53 \text{ (2dp)}}}$$

ii $5 \tan x = -7$
 $\tan x = -\frac{7}{5}$
 $x = \tan^{-1}\left(-\frac{7}{5}\right)$
 $x = -54.46 \text{ (2dp)}$
'ignore negative'
 $x = 54.46 \text{ (2dp)}$

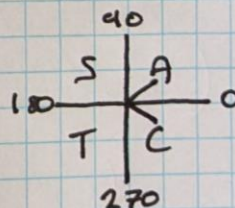


$$x = 180 - 54.46 = \underline{\underline{125.54 \text{ (2dp)}}}$$

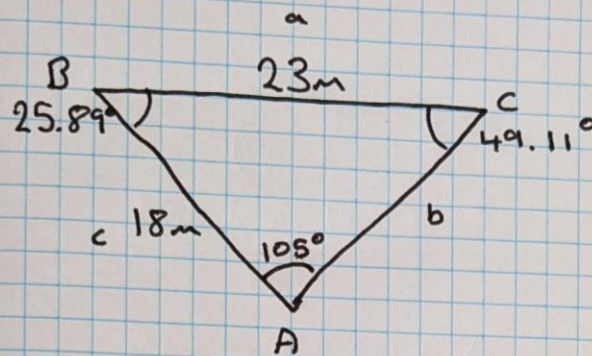
$$x = 360 - 54.46 = \underline{\underline{305.54 \text{ (2dp)}}}$$

iii $5 \cos x = 3$

$$\cos x = \frac{3}{5}$$
$$x = \cos^{-1}\left(\frac{3}{5}\right) = \underline{\underline{53.13 \text{ (2dp)}}}$$
$$360 - 53.13 = \underline{\underline{306.87 \text{ (2dp)}}}$$



3)



$$i \quad \frac{c}{\sin C} = \frac{a}{\sin A} \quad \therefore \frac{18}{\sin C} = \frac{23}{\sin 105}$$

$$18(\sin 105) = 23(\sin C)$$

$$\frac{18(\sin 105)}{23} = \sin C$$

$$\sin^{-1}\left(\frac{18(\sin 105)}{23}\right) = C = \underline{49.11^\circ (2dp)}$$

$$ii \quad 180 - 105 - 49.11 = \underline{25.89^\circ (2dp)}$$

$$iii \quad \frac{b}{\sin B} = \frac{a}{\sin A} \quad \therefore \frac{b}{\sin 25.89} = \frac{23}{\sin 105}$$

$$b(\sin 105) = 23(\sin 25.89)$$

$$b = \frac{23(\sin 25.89)}{(\sin 105)} = \underline{10.40m (2dp)}$$

$$4) y = \frac{t(x^2 + R)}{\theta}$$

$$y\theta = t(x^2 + R)$$

$$\frac{y\theta}{t} = x^2 + R$$

$$\frac{y\theta}{t} - R = x^2$$

$$x = \sqrt{\frac{y\theta}{t} - R} \leftarrow \text{Answer}$$

$$5) i \quad 3^{x+4} = 7^x$$

$$\log 3^{(x+4)} = \log 7^x$$

$$(x+4)\log 3 = x\log 7$$

$$(x+4) 0.477 = 0.845x \quad (3dp)$$

$$0.477x + 1.908 = 0.845x$$

(3dp)

$$0.845x - 0.477x = 1.908$$

(3dp)

$$0.368x = 1.908$$

$$\underline{\underline{x = 5.185 \quad (3dp)}}$$

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5) ii $\log(x+5) + \log(x+2) = \log(x+7) + \log(x+6)$

$$\log(x+5)(x+2) = \log(x+7)(x+6)$$

$$(x+5)(x+2) = (x+7)(x+6)$$

$$x^2 + 2x + 5x + 10 = x^2 + 6x + 7x + 42$$

$$x^2 + 7x + 10 = x^2 + 13x + 42$$

$$7x + 10 = 13x + 42$$

$$7x - 13x = 42 - 10$$

$$-6x = 32$$

$$\underline{\underline{x = -5.33}}$$

6) i $\int x^8 + 4x^3 + 5x - 1 \, dx$

$$= \frac{x^9}{9} + \frac{4x^4}{4} + \frac{5x^2}{2} + x + C$$

$$\frac{x^9}{9} + x^4 + \frac{5}{2}x^2 + x + C \leftarrow \text{Answer}$$

ii $\int 5x^2(x^3 + 2x + 1) \, dx$

$$\int 5x^5 + 10x^3 + 5x^2 \, dx$$

$$= \frac{5x^6}{6} + \frac{10x^4}{4} + \frac{5x^3}{3} + C \leftarrow \text{Answer}$$

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iii $\int 5 \sin 3x \, dx$

$$= \cancel{\frac{5}{3}} 5x - \frac{1}{3} \cos 3x + C$$

$$= -\frac{5}{3} \cos 3x + C \leftarrow \text{Answer}$$

iv $\int_0^5 (x+5)(x+1) \, dx$

$$\int_0^5 x^2 + x + 5x + 5 \, dx = \int x^2 + 6x + 5 \, dx$$

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

input 5

$$\frac{5^3}{3} + \frac{6(5)^2}{2} + 5 = 121.6$$

$$121.6 - 0 = \underline{\underline{121.6}}$$

↑
Answer

input 0

$$\frac{0^3}{3} + \frac{6(0)^2}{2} + 0 = 0$$