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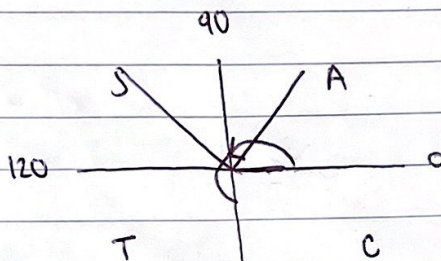
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ACFA4000 Further Mathematics Exam Paper

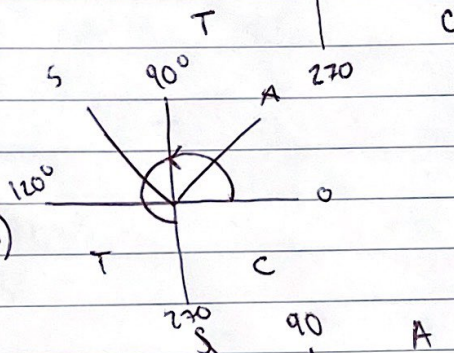
12 May 2010, 1pm

Question One.

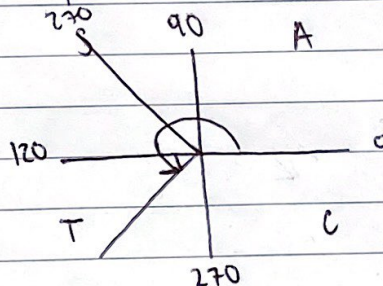
a) $\sin x = 0.82$
 $x = \sin^{-1}(0.82)$
 $x = 55.08^\circ$



b) $7 \tan x = 3$
 $x = 7 \tan^{-1}(3)$
 $x = 71.56^\circ$



c) $\cos x = -0.53$
 $x = \cos^{-1}(-0.53)$
 $x = 122.01^\circ$



Question Two.

a) $y = 8x^5 - 4x^3 + 2x + 5$

$$\frac{dy}{dx} = 40x^4 - 12x^2 + 2$$

b) $y = (x+10)(x^2-1)$

$$y = x^2 + 9x + 10$$

$$\frac{dy}{dx} = 2x + 9$$

c) $y = 5x^3(2x^2 + 5x + 1)$

Simplified

$$\frac{dy}{dx} = 15x^2(2x + 5x + 1) + 5x^3(4x + 5) \quad \frac{dy}{dx} = 10x^4 + 100x^3 + 15x^2$$

d) $y = \tan 5x - \cos x$

$$\frac{dy}{dx} = 5\sec^2 5x - \sin x$$

e) $y = \frac{1}{x^3}$

$$y = x^{-3} \quad y = -\frac{3}{x^4}$$

f) $y = x^3 \sin 5x$ using the product rule

$$\frac{du}{dx} = 3x \quad \frac{dv}{dx} = -\cos 5x$$

$$\frac{dy}{dx} = (\sin 5x)(3x) + (x^3)(-\cos 5x)$$

g) $y = \frac{e^{6x}}{\sin x}$ using quotient rule

$$\frac{du}{dx} = 6e^{6x} \quad \frac{dv}{dx} = \cos x$$

$$\frac{dy}{dx} = \frac{(\sin x)(6e^{6x}) - (e^{6x})(\cos x)}{(\sin x)^2}$$

h) $y = (6x^3 + 2x + 3)^5$ using quotient rule

Answer

$$\frac{dy}{dx} = 5(6x^3 + 2x + 3)^4 (18x^2 + 2)$$

$$\frac{dy}{dx} = (108x^3 + 10x + 30)^2 (18x^2 + 2)$$

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Question Three

$$\begin{aligned} \text{a) } \int 5x^2 + 6x + 5 \, dx \\ = \frac{5x^3}{3} + \frac{3x^2}{1} + 5x + C \end{aligned}$$

$$\text{b) } \int \frac{1}{x^8} \, dx$$

$$= \int x^{-8} \, dx$$

$$= \frac{1}{-7x^7} + C$$

$$\begin{aligned} \text{c) } \int 3 \sin 4x \, dx \\ = -\frac{3}{4} \cos(4x) + C \end{aligned}$$

$$\text{d) } \int_2^5 (x+5)(x+2) \, dx$$

$$\int_2^5 x^2 + 5x + 2 \, dx \quad \left[\frac{x^3}{3} + \frac{5x^2}{2} + 2x \right]$$

$$\left[\frac{(5)^3}{3} + \frac{5(5)^2}{2} + 2(5) \right] - \left[\frac{(2)^3}{3} + \frac{5(2)^2}{2} + 2(2) \right]$$

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$$\left[41.6 + \frac{62.5}{312.5} + 10 \right] - \left[2.6 + \frac{10}{20} + 4 \right]$$

$$\left[114.1 \right] - \left[16.6 \right]$$

$$= 97.5$$

Question Four

- a) Angle R = 36°
Length of Side RP = 8.5m

$$\tan 36 = \frac{RP}{5} = \frac{8.5}{5} \quad \text{or} \quad \frac{8.5}{5} = \tan 36 \quad \text{or} \quad \frac{8.5}{5} = \tan 36 \quad \text{or} \quad \frac{8.5}{5} = \tan 36$$

- b) A = 105°
BC = 14.15m

$$(BC)^2 = (7)^2 + (2)^2 - 2(7)(2) \cos 105$$

$$(BC)^2 = 49 + 4 - 28 \cos 105$$

$$BC = \sqrt{200.25}$$

$$BC = 14.15m$$

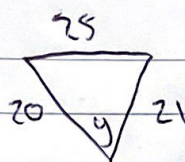
Angle A =



$$\frac{15}{\sin 105} = \frac{20}{\sin A} = \frac{25}{\sin B}$$

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c)



$$a = \sqrt{c^2 - b^2}$$

$$= \sqrt{20^2 - 12.5^2}$$

$$= \sqrt{243.75}$$

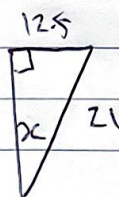
$$a = 15.61$$

$$\alpha = \frac{12.5}{20}$$

$$\sin = 0.625$$

$$= 0.67513 \text{ rad} = 38.682^\circ$$

$$\alpha = 38.682^\circ$$



$$\sin \frac{12.5}{21}$$

$$\sin = 0.595238$$

$$= 0.63756 \text{ rad}$$

$$= 36.53^\circ$$

$$38.6 + 36.5 = 75.1^\circ$$

$$y = 75^\circ$$