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05/05/2022 ACHA4006

Further Mathematics for Engineering

Freddie
Watkins
2107574

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

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

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

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

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

$$\frac{dy}{dx} = -6x^{-7} + 5 \sin 5x$$

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

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

v) $y = \frac{\tan 7x}{\sin x} \quad \frac{dy}{dx} = \frac{1 \sec^2 7x}{\cos x}$

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

$$\frac{dy}{dx} = \sqrt{12x - 3}$$

$$2) \text{ i) } \sin x = 0.43$$

$$x = \sin^{-1} 0.43$$

$$x = 25.46, \quad x = 154.53$$

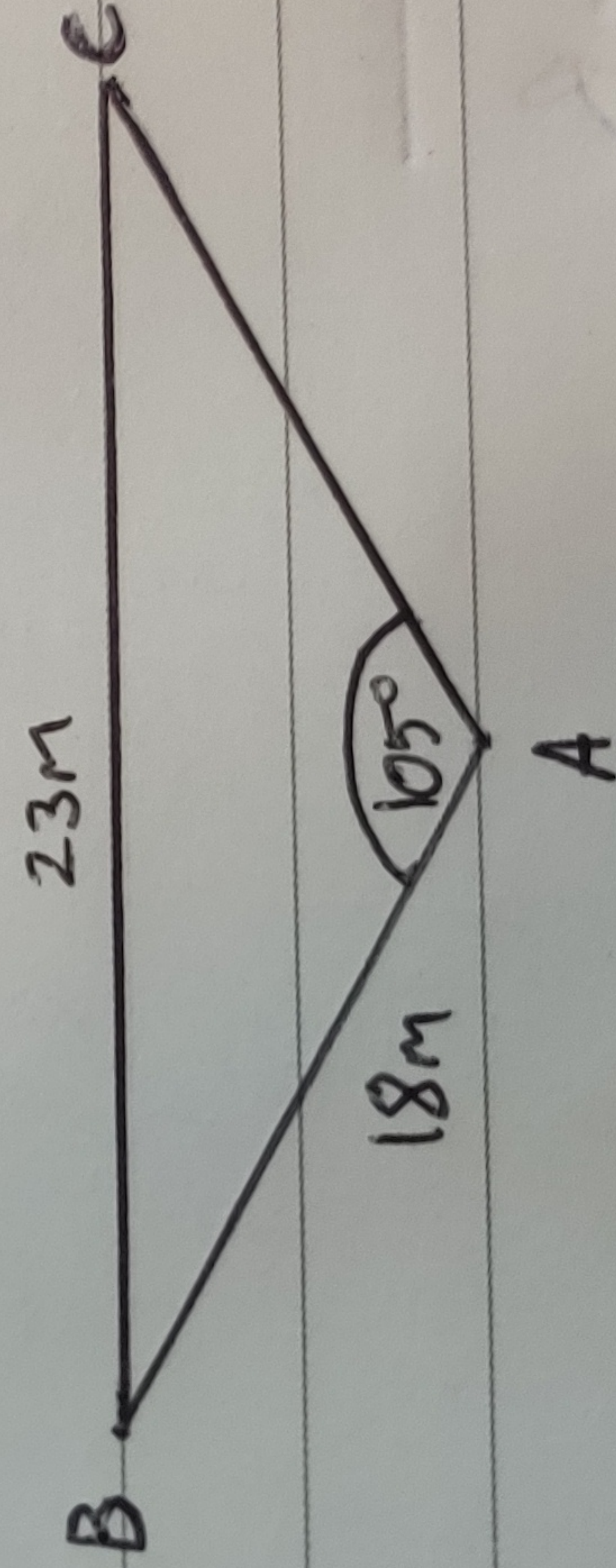
$$\text{ii) } 5 \tan x = -7$$

$$\tan^{-1} \left(-\frac{7}{5} \right) = 125.5, \quad 305.54$$

$$\text{iii) } 5 \cos x = 3$$

$$\cos^{-1} (0.6) = 53.13, \quad 306.87$$

3)



$$\text{i) } \left(\frac{\sin 105}{23} \times 18 \right) \sin^{-1} = 49.11^\circ$$

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$$\text{ii) } 105 + 49.11 = 154.11$$

$$180 - 154.11 = 25.89^\circ$$

$$\text{Angle } B = 25.89^\circ$$

$$\text{iii) } \frac{23}{\sin 105} \times \sin 25.89 = 10.4 \text{ m}$$

$$\text{Length } AC = 10.4 \text{ m}$$

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

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

$$y\theta = tx^2 + tR$$

$$y\theta - tR = tx^2$$

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

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

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

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

$$(x+4)0.48 = 80.85x$$

$$0.48x + 1.92 = 0.85x$$

$$1.92 = 0.37x$$

$$x = 5.19$$

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

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

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

$$\cancel{x^2+5x+2x+10} = \cancel{x^2+7x+6x+42}$$

$$x^2 + 5x + 2x + 10$$

$$x^2 + 7x + 10 = x^2 + 13x + 42 \quad -10$$

$$x^2 + 7x = x^2 + 13x + 32$$

$$7x = 13x + 32 \quad -13x$$

$$-6x = 32 \quad \div -6$$

$$x = -5.33$$

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

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

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

$$5x^6 + 10x^2 + 5x^2$$

$$\frac{5x^7}{7} + \frac{10x^3}{3} + \frac{5x^3}{3} + C$$