

Josh Brown
Analytical methods
13/05/21

2004738
exam 1

i) $y = 2\sqrt{\frac{3}{x^3}}$

$$12/y^2 = x^2$$

$$y/2 = \sqrt{3/x^2}$$

$$y^2/4 = 3/x^2$$

$$4/y^2 = x^2/3$$

$$12/y^2 = x^2/3$$

$$x = \sqrt{12}/y^2$$

$$x = \frac{\sqrt{12}}{y}$$

b) $\frac{2x+3}{4} = \frac{5x+1}{-3}$

$$-3(2x+3) = 4(5x+1)$$

$$-6x + -9 = 20x + 4$$

$$-9 - 4 = 20 + 6x$$

$$-13 = 26x$$

$$x = 0.5$$

ii) $\frac{(x-1)}{2} - \frac{5x}{4} = \frac{(x+2)}{2}$ C.F = 4

$$4\left(\frac{x-1}{2}\right) - 4\left(\frac{5x}{4}\right) = 4\left(\frac{x+2}{2}\right)$$

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

$$2x - 2 - 5x = 2x + 4$$

$$2x - 5x + 2x = 4 + 2$$

$$\text{iii) } 2 \log(x+3) = \log(x+5) + \log(x+7)$$

3rd law

$$\log(x+3)^2 = \log(x+5)(x+7)$$

$$(x+3)^2 = (x+5)(x+7)$$

$$(x+3)(x+3) = (x+5)(x+7)$$

$$6x+9 = 12x+35$$

$$6x+12x = 35$$

$$-6x = 26$$

$$x = -4.3$$

$$\text{iv) } 4^x \times 3^{x+5} = 2^x$$

$$x \log 4 + (x+5) \log 3 = x \log 2$$

$$(x+5) \log 3 = \frac{x \log 2}{x \log 4}$$

$$(x+5) \log 3 = 1/2$$

$$x+5 = 1/2 (\log 3)$$

$$x = 1/2 \log 3 - 5$$

$$x = -3.9$$

$$\text{C) } T^2 + 11T + 30$$

$$(T+6)(T+5)$$

$$\text{ii) } 4x^2 - 10ay^2$$

$$(2x)^2 - (10y)^2$$

$$\text{iii) } Tr - Ty + ur - uy$$

$$T(r-y) + u(r-y)$$

$$d) x^2 + 19x + 90 = 0$$

$$(x+10)(x+9) = 0$$

$$x = -10 \quad x = -9$$

$$ii) x^2 - 5x + 6 = 0$$

$$(x-3)(x-2) = 0$$

$$x = 3 \quad x = 2$$

$$iii) x^2 + 8x = 9$$

$$x^2 + 8x - 9 = 0$$

$$(x+9)(x-1) = 0$$

$$x = -9 \quad x = 1$$

$$iv) x^2 - 225 = 0$$

$$(x-15)(x+15) = 0$$

$$x = 15 \quad x = -15$$

$$e) (x+2)^2 - x^2 - 2 = (x+5)(x+1) - x^2$$

$$(x+2)(x+2) - x^2 - 2 = x^2 + x + 5x - x^2$$

$$x^2 + 2x + 2x + 4 - x^2 - 2 = 6x + 5$$

$$4x + 2 = 6x + 5$$

$$0 = 2x + 3$$

$$-3/2 = x$$

$$3) \quad \underset{a}{15}x^2 = \underset{b}{14}x + \underset{c}{20}$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-14 \pm \sqrt{14^2 - 4 \cdot (15)(20)}}{2 \cdot (15)}$$

$$x = \frac{-14 \pm \sqrt{196 - 1200}}{30}$$

$$x = \frac{-14 \pm \sqrt{-1004}}{30}$$

$$x = \frac{-14 \pm 31.68}{30}$$

~~$$x = \frac{-14 \pm 31.68}{30}$$~~

$$x = -14 \pm 1.056$$

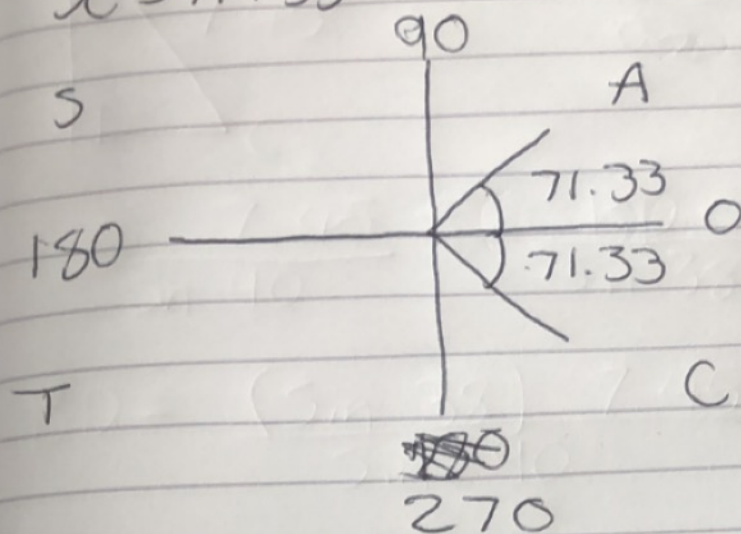
$$x = -14 + 1.056$$

$$x = -14 - 1.056$$

$$x = -12.94$$

$$x = -15.05$$

b) $\cos x = 0.32$
 $x = \cos^{-1} 0.32$
 $x = 71.33^\circ$

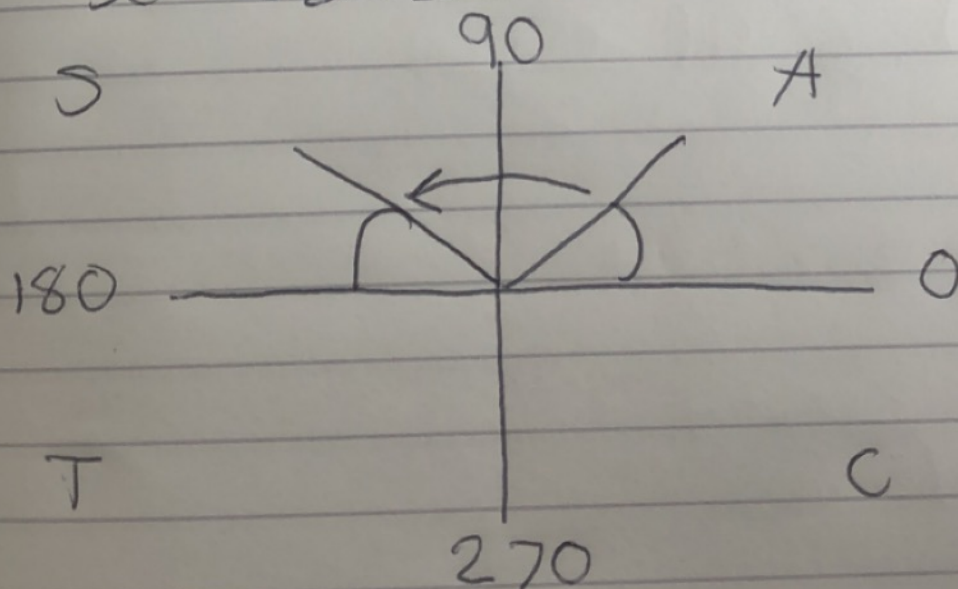


$360 - 71.33 = 288.67$
 $\cos(288.67) = 0.32$

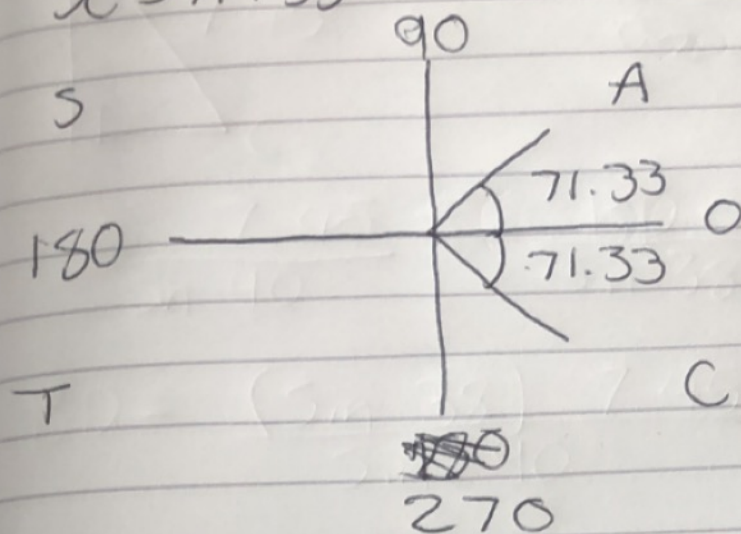
$2C = 0.32$

ii) $8 \sin x = 3$
 $\sin x = 3/8$

$x = \sin^{-1}(3/8)$
 $x = 22.02$



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 $x = \cos^{-1} 0.32$
 $x = 71.33^\circ$

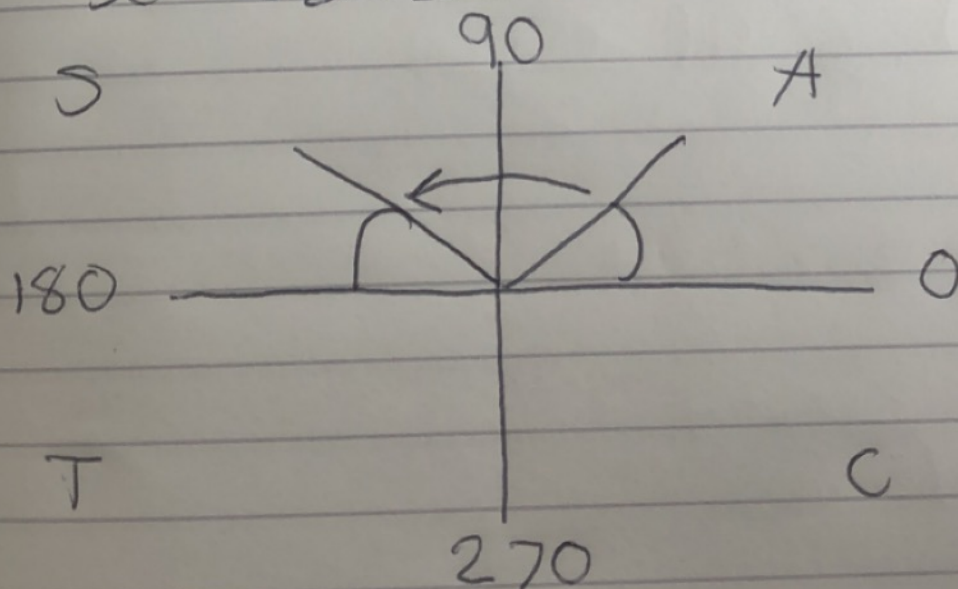


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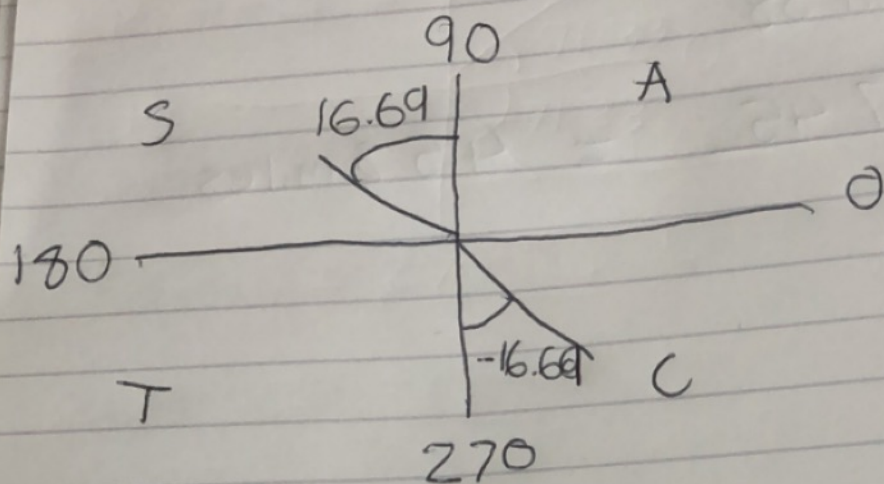


$$\text{iii) } -10 \tan x = 3$$

$$\tan x = \frac{3}{-10}$$

$$x = \tan^{-1}(3/-10)$$

$$x = -16.69^\circ$$



$$x_C = 270 + 16.69$$

$$x_C = 286.69$$

$$x_C = \tan^{-1}(286.69)$$

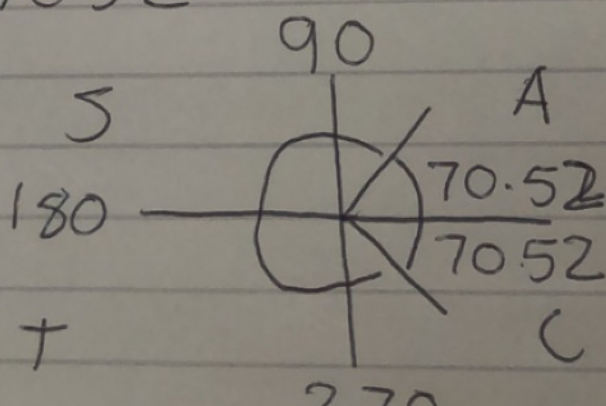
$$x_C = \underline{\underline{-3.33}}$$

$$\text{iv) } -3 \cos x = -1$$

$$\cos x = -1/-3$$

$$x = \cos^{-1}(-1/-3)$$

$$x = 70.52$$



$$x = 360 - 70.52^\circ$$

$$x = 289.48$$

$$x = \cos^{-1}(289.48)$$

$$x = 0.33^\circ$$

$$C) x^2 - 7x + 10$$

$$(x-5)(x-2)$$

$$x=5 \quad x=2$$

$$\tan \theta = 5 \quad \tan \theta = 2$$

$$x = \tan^{-1}(5) \quad x = \tan^{-1}(2)$$

$$x = 78.7 \quad x = 63.43$$

$$D) y = \cos^2(2\theta/5)$$

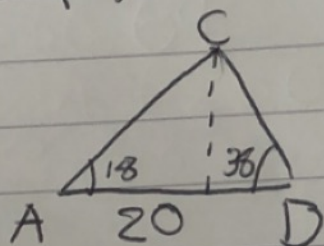
$$\sqrt{y} = \cos(2\theta/5)$$

$$\cos^{-1}(\sqrt{y}) = 2\theta/5$$

$$5 \cos^{-1}(\sqrt{y}) = 2\theta$$

$$5/2 \cos^{-1}(\sqrt{y}) = \theta$$

E)



$$\angle ACB = 124^\circ$$

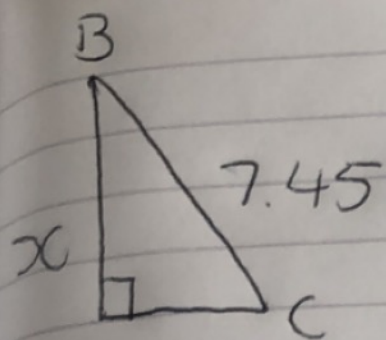
$$\angle CAB = 18^\circ$$

$$\angle CBA = 38^\circ$$

$$\frac{AC}{\sin 38} = \frac{20}{\sin 124}$$

$$AC = \frac{20 (\sin 38)}{\sin 124} = 14.8 \text{ miles}$$

$$\frac{BC}{\sin 18} = \frac{20}{\sin 124}$$



$$\angle A = 38$$

$$\angle 2 = 180 - (38 + 90)$$

$$\angle 2 = 52$$

$$\frac{7.45}{\sin 90} = \frac{BD}{\sin 38}$$

$$BD = \frac{(\sin 38) 7.45}{\sin 90} = 4.58 \text{ miles}$$