

Elliot Shaw

Analytical Methods Exam

ACHA4000

11 / 11 / 2020.

Question 3.

A) i): $12x^2 = 31x + 15.$

$$12x^2 - (31x + 15) = 31x + 15 - (31x + 15) = 12x^2 - 31x - 15 = 0$$

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-(-31) \pm \sqrt{(-31)^2 - 4(12)(-15)}}{2(12)} :$$

$$\frac{31 \pm \sqrt{961 - -720}}{24} = \frac{31 \pm \sqrt{1681}}{24} = \frac{31 + 41}{24} / \frac{31 - 41}{24}$$

$x = 3$ $x = -0.416$

B) i): $\cos x = 0.62$

$$\cos^{-1}(0.62) = 51.68^\circ$$

$$360 - 51.68 = 308.32^\circ$$

ii): $7 \sin x = 4$

$$\sin^{-1}(4/7) = 34.85^\circ$$

$$180 - 34.85 = 145.15^\circ$$

iii): $-5 \tan x = 4$

$$\tan x = -4/5$$

$$\tan x = -4/5$$

$$\tan^{-1}(4/5) = 38.66^\circ$$

$$180 + 38.66 = 218.66^\circ$$

$$180 - 38.66 = 141.34^\circ$$

Question 3

$$b) = iv) = -3 \sin x = -2$$

$$\sin^{-1} \left(\frac{2}{3} \right) = 41.81^\circ$$

$$180 - 41.81^\circ = 138.19^\circ$$

$$c) = \text{Factorise } x^2 + 3x - 10. \text{ Solve the following: } \tan^2 x + 3x - 10 = 0$$

$$(x-2)(x+5) = (\tan x - 2)(\tan x + 5) = 0 \rightarrow \tan x = 2$$

$$\tan x = 5$$

$$x = \tan^{-1} 2 = 63.43^\circ \quad x = \tan^{-1} 5 = 78.69^\circ$$

$$180 + 63.43 = 243.43^\circ$$

$$180 + 78.69 = 258.69^\circ$$

$$d) = y = \sin^2 \left(\frac{3\theta}{2} \right)$$

$$y = \frac{\sin^2(3\theta)}{2}$$

$$y = \frac{3 \sin 2\theta}{2}$$

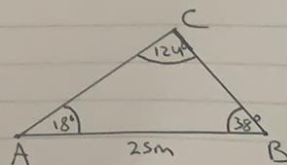
$$\theta = \frac{2y}{3 \sin^2}$$

e) = "Sine rule"

$$180 - 38 - 18 = 124^\circ$$

find AC, BC

$$\frac{BC}{\sin 124} = \frac{AC}{\sin 18} = \frac{AB}{\sin 38}$$



$$AC = \frac{25 (\sin 18)}{\sin 38} = \frac{7.75}{0.615} = 12.60 \text{ miles.}$$

Question 3

$$E) \text{ (continued)} = \frac{BC}{\sin 124} = \frac{12.60}{\sin 18} = \frac{25}{\sin 38}$$

$$\frac{BC}{\sin 124} = \frac{12.60}{\sin 18} \quad BC = \frac{12.60 (\sin 124)}{\sin 18} = \frac{10.45}{0.31} = 33.7 \text{ miles}$$

$$\text{height of Plane} = 33.7 - 25 = 8.7 \text{ miles}$$

$$38 + 90 = 128^\circ \quad 180 - 128 = 52^\circ \quad \frac{1}{2} \times b \times h$$

$$h = \frac{\frac{1}{2} \times b}{a}$$

Question 2.

$$a) i) = 8x^3 - 2x^2 + x + 10 = 24x^2 - 4x + 1$$

$$ii) = (5x-3)(6x-1) = \frac{dy}{dx} = 30x^2 - 27x + 3 = 900x - 27.$$

$$iii) = \frac{3}{\sqrt{x}} = \ln x =$$

