

Q1)

$$a) i - \frac{3x-1}{5} = \frac{6x+5}{9}$$

$$27x - 9 = 30x + 25$$

$$-30x = 34$$

$$x = \frac{34}{-3} = \boxed{-11.33(3)}$$

$$ii - 1 + \frac{5}{x} = \frac{-6}{x^2}$$

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

$$x^2 + 5x + 6 = 0$$

$$x = \frac{-5 \pm \sqrt{5^2 - 4 \times 1 \times 6}}{2 \times 1}$$

$$x = \frac{-5 \pm \sqrt{1}}{2}$$

$$x = \frac{-5+1}{2} \wedge x = \frac{-5-1}{2}$$

$$x = \frac{-4}{2} \wedge x = \frac{-6}{2}$$

$$\boxed{x = -2 \wedge x = -3}$$

JOAO FERREIRA (1902427)

10/01/22

iii- $2 \log(3x+1) = \log(x+3) + \log(x+7)$

$$\log(3x+1)^2 = \log(x+3) + \log(x+7)$$

$$\log(3x+1)^2 = \log(x+3)(x+7)$$

$$(3x+1)(3x+1) = (x+3)(x+7)$$

$$9x^2 + 3x + 3x + 1 = x^2 + 7x + 3x + 21$$

$$8x^2 - 4x - 20 = 0$$

$$x = \frac{-(-4) \pm \sqrt{(-4)^2 - 4 \times 8 \times (-20)}}{2 \times 8}$$

$$x = \frac{+4 \pm \sqrt{16 + 640}}{16}$$

$$x = \frac{4 + \sqrt{656}}{16} \vee x = \frac{4 - \sqrt{656}}{16}$$

$$x = 1.85 \vee x = -1.35$$

b) i- $8P^3Q^2 - 4P^2Q^3 + 2P^3Q$
 $2P^2Q(4PQ - 2Q^2 + P)$

ii- $x^2 - y^2$

$$(x+y)(x-y)$$

c) i- $x^2 + 12x + 20 = 0$
 $(x+2)(x+10) = 0$

$$x = -2 \vee x = -10$$

ii- $2x^2 + x - 15 = 0$
 $(2x-5)(x+3) = 0$

$$x = 2.5 \vee x = -3$$

$$\text{iii} - x^2 - 400 = 0$$

$$(x+20)(x-20) = 0$$

$$\boxed{x = -20} \quad \boxed{x = 20}$$

Q2)

i - ~~100~~

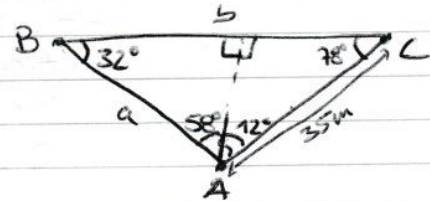
$$\text{Angle @ C} = 180^\circ - 70^\circ - 32^\circ = 78^\circ$$

~~$$\tan 32^\circ = \frac{35}{AB}$$

$$AB = 56.01 \text{ km}$$~~

~~$$\sin 32^\circ = \frac{35}{BC}$$

$$BC = 66.25 \text{ km}$$~~



~~$$\frac{AB}{\sin 78^\circ} = \frac{BC}{\sin 70^\circ} = \frac{35}{\sin 32^\circ}$$

$$AB = \frac{35 \sin 78^\circ}{\sin 70^\circ}$$

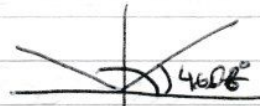
$$BC = \frac{35 \sin 78^\circ}{\sin 32^\circ}$$~~

JOAO FERREIRA (1902427)

10/01/22

Q3

a) i - $\sin x = 0.67$
 $x = \sin^{-1}(0.67) = 46.07^\circ$

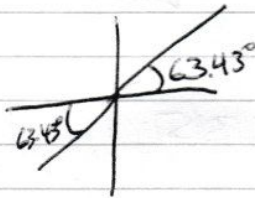


$x = 46.07$ $x = 180 - 46.07 = 133.94^\circ$

ii - $\tan^2 x - 7 \tan x + 10 = 0$

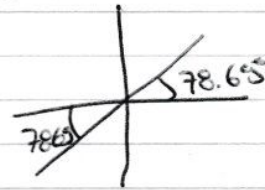
$(\tan x - 2)(\tan x - 5) = 0$

$\tan x - 2 = 0$
 $\tan x = 2$
 $x = \tan^{-1}(2)$
 $x = 63.43^\circ$



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

$\tan x - 5 = 0$
 $\tan x = 5$
 $x = \tan^{-1}(5)$
 $x = 78.69^\circ$



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

Q4)

Q5

a) i - $z_1 + z_2$

$$3 + 7j + 2 - 10j$$

$$\boxed{5 - 3j}$$

ii - ~~$z_1 - z_2$~~ $z_1 - \bar{z}_2$
 ~~$3 + 7j - (2 - 10j)$~~ $3 + 7j - (2 - 10j)$
 ~~$1 + 17j$~~ $\boxed{1 - 3j}$

iii - $\frac{z_1}{z_2} = \frac{3 + 7j}{2 - 10j} \times \frac{2 + 10j}{2 + 10j}$

$$= \frac{(3 + 7j)(2 + 10j)}{(2 - 10j)(2 + 10j)}$$

$$= \frac{6 + 30j + 14j + 70j^2}{4 + 20j - 20j - 100j^2}$$

$$= \frac{-64 + 44j}{104}$$

$$= \left(\frac{-64}{104} + \frac{44j}{104} \right)$$

b) $7x^2 = -2x - 11$

$$7x^2 + 2x + 11 = 0$$

$$x = \frac{-2 \pm \sqrt{4 \times 7 \times 11}}{2 \times 7}$$

$$x = \frac{-2 \pm \sqrt{-308}}{-2}$$

$$x = \frac{-2 \pm 18j}{-2}$$

$$x = 1 + (-9j) \quad x = 1 - 9j$$

$$x = 1 + 9j \quad x = 1 + 9j$$

c) $(5+3j)^4$

Q6

a) i - $y = 9x^3 + 7x^2 - x + 4$

$$\boxed{\frac{dy}{dx} = 27x^2 + 14x - 1}$$

ii - $y = (2x+3)(3x-5)$
 $y = 6x^2 - 10x + 9x - 15$

$$\boxed{\frac{dy}{dx} = 12x + 1}$$

iii - $y = 2 \ln x + \frac{5}{x}$

$$y = \frac{2}{x} + \frac{5}{x}$$

$$y = 2x^{-1} + 5x^{-1}$$

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

iv - $y = 7 \sin x + 3 \cos 2x + \tan 0.5x$

$$\boxed{\frac{dy}{dx} = 7 \cos x + \sin 2x + 0.5 \sec^2(0.5x)}$$

$$v - y = x^5 \sin 2x$$

$$\boxed{\frac{dy}{dx} = 5x^4 \cdot 2 \cos 2x}$$

$$vi - y = \frac{e^{3x}}{x^3}$$

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

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

$$\frac{dy}{dx}$$

Q7

$$a) i - \int x^5 + 2x^2 + x - 10 \, dx$$

$$= \left[\frac{x^6}{6} + \frac{2x^3}{3} + \frac{x^2}{2} - 10x \right]$$

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

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

$$\left[\frac{2x^4}{4} + \frac{5x^3}{3} - \frac{3x^2}{2} - 5x \right]$$

$$iii - \int_2^5 2x^2(x^2+3) \, dx$$

JOAO FERREIRA (1902477)

10/01/22

iv $\int 5 \sin 3x - \cos \frac{x}{3} dx$