

QQQ – Further Pure 1 – Chapter 5 – The t-formulae (Version 1)

Total Marks: 23

(23 = Platinum, 21 = Gold, 18 = Silver, 16 = Bronze)

1.

(a) Write down the t -formula for $\sin x$. **(1)**

(b) Use the answer to part (a)

(i) to find the exact value of $\sin x$ when

$$\tan\left(\frac{x}{2}\right) = \sqrt{2}$$

(ii) to show that

$$\cos x = \frac{1 - t^2}{1 + t^2}$$

(4)

(c) Use the t -formulae to solve for $0 < \theta \leq 360^\circ$

$$7 \sin \theta + 9 \cos \theta + 3 = 0$$

giving your answers to one decimal place. **(4)**

(Total 9 marks)

2.

- (a) Use $t = \tan \frac{\theta}{2}$ to show that, where both sides are defined

$$\frac{29 - 21 \sec \theta}{20 - 21 \tan \theta} \equiv \frac{5t + 2}{2t + 5}$$

(4)

- (b) Hence, again using $t = \tan \frac{\theta}{2}$, prove that, where both sides are defined

$$\frac{20 + 21 \tan \theta}{29 + 21 \sec \theta} \equiv \frac{29 - 21 \sec \theta}{20 - 21 \tan \theta}$$

(3)

(Total 7 marks)

Edexcel AS June 2022 Q3

3. During 2029, the number of hours of daylight per day in London, H , is modelled by the equation

$$H = 0.3 \sin \left(\frac{x}{60} \right) - 4 \cos \left(\frac{x}{60} \right) + 11.5 \quad 0 \leq x < 365$$

where x is the number of days after 1st January 2029 and the angle is in radians.

- (a) Show that, according to the model, the number of hours of daylight in London on the 31st January 2029 will be 8.13 to 3 significant figures. (1)
- (b) Use the substitution $t = \tan \left(\frac{x}{120} \right)$ to show that H can be written as

$$H = \frac{at^2 + bt + c}{1 + t^2}$$

where a , b and c are constants to be determined. (2)

- (c) Hence determine, according to the model, the date of the first day of 2029 when there will be at least 12 hours of daylight in London. (4)

(Total 7 marks)

Edexcel A2 June 2022 Q2