

QQQ – Further Pure 1 – Chapter 8 – Numerical Methods (Version 2)

Total Marks: 23

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

1.

- (a)** Use Simpson's rule with 4 intervals to find an estimate for

$$\int_0^2 e^{\sin^2 x} dx$$

Give your answer to 3 significant figures. **(4)**

Given that $\int_0^2 e^{\sin^2 x} dx = 3.855$ to 4 significant figures,

- (b)** comment on the accuracy of your answer to part (a). **(1)**

(Total 5 marks)

2.

(a) Given that

$$y = e^{\operatorname{cosec}^2 x}$$

complete the table below with the value of y corresponding to $x = 2$, giving your answer to 2 decimal places.

x	1.5	1.75	2	2.25	2.5
y	2.73	2.81		5.22	16.31

(1)

(b) Use Simpson's rule, with all the values of y in the completed table, to estimate, to one decimal place, the value of

$$\int_{1.5}^{2.5} e^{\operatorname{cosec}^2 x} \mathrm{d}x$$

(3)

(c) Using your answer to part (b) and making your method clear, estimate the value of

$$\int_{1.5}^{2.5} e^{\cot^2 x} \mathrm{d}x$$

(2)

(Total 6 marks)

3. An area of woodland contains a mixture of blue and yellow flowers.

A study found that the proportion, x , of blue flowers in the woodland area satisfies the differential equation

$$\frac{dx}{dt} = \frac{xt(0.8 - x)}{x^2 + 5t} \quad t > 0$$

where t is the number of years since the start of the study.

Given that exactly 3 years after the start of the study half of the flowers in the woodland area were blue,

- (a) use one application of the approximation formula $\left(\frac{dy}{dx}\right)_n \approx \frac{y_{n+1} - y_n}{h}$ to estimate the proportion of blue flowers in the woodland area half a year later. **(5)**
- (b) Deduce from the differential equation the proportion of flowers that will be blue in the long term. **(1)**

(Total 6 marks)

Edexcel AS June 2024 Q2

4. The velocity $v \text{ m s}^{-1}$, of a raindrop, t seconds after it falls from a cloud, is modelled by the differential equation

$$\frac{dv}{dt} = -0.1v^2 + 10 \quad t \geq 0$$

Initially the raindrop is at rest.

- (a) Use two iterations of the approximation formula $\left(\frac{dy}{dx}\right)_n \approx \frac{y_{n+1} - y_n}{h}$ to estimate the velocity of the raindrop 1 second after it falls from the cloud. **(5)**

Given that the initial acceleration of the raindrop is found to be smaller than is suggested by the current model,

- (b) refine the model by changing the value of one constant. **(1)**

(Total 6 marks)

Edexcel A2 June 2022 Q4