James Ruse Agricultural High School
Year 12 Term1 Mathematics

Question 1 **Marks**

(a) Find: (i) $\int(4\sin 2x - 6\cos 3x)\ dx$ **1**

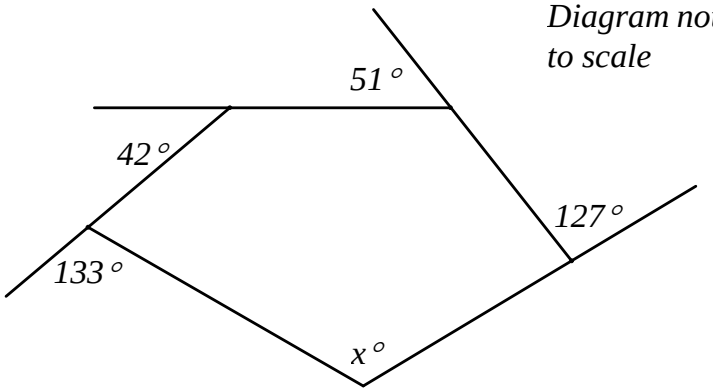
(ii) $\int \frac{4x^3+3x^2-7}{x^4+x^3-7x+4}\,dx$ **1**

(iii) $\int \frac{3x^2+4x-1}{\sqrt{x}}\,dx$ **2**

(b) Evaluate: (i) $\int_{\frac{1}{4}}^{1}(4x-3)^2 dx$ **2**

(ii) $\int_{-1}^{1}\sqrt{1-x^2}\,dx$ **1**

(c) Find the value of *x*, giving reasons. **4**



(d) By writing $0.\dot{1}\dot{2}$ as a series, express $0.\dot{1}\dot{2}$ as a fraction in simplest terms. **2**

(e) Graph $y = \frac{x+2}{x-1}$ showing all asymptotes and intercepts with the *x* and *y* axes. **2**

Question 2 (Start A New Page) **Marks**

(a) (i) Graph the region defined by **:** **2**

$y \geq \sqrt{x}, \quad y \leq x^2 + 1, \quad x \geq 0 \text{ and } x \leq 4.$

(ii) Find the area of the region in (i). **2**

(iii) The region in (i) is rotated about the *x* axis. **3**
Find the Volume of the solid of revolution.

(iv) The region in (i) is rotated about the *y* axis. **4**
Find the Volume of the solid of revolution.

(b) Using the Trapezoidal Rule using 2 strips evaluate (to 4 significant figures) $\int_0^1 e^{\sin x}\,dx$ **2**

(c) The gradient function of a curve is given by **:** **2**

$$\frac{dy}{dx} = e^x(e^x + e^{2x})$$

Find *y* as a function of *x* if the point $(\ln 2, 1)$ lies on the curve.

Question 3 (Start a New Page) **Marks**

(a) Find: $\int 3sec3x\ tan3x\,dx$ **1**

(b) On the same axes in the domain $0 \le x < \pi$ graph $y = cos\frac{x}{2}$ and $y = sec\frac{x}{2}$. **4**

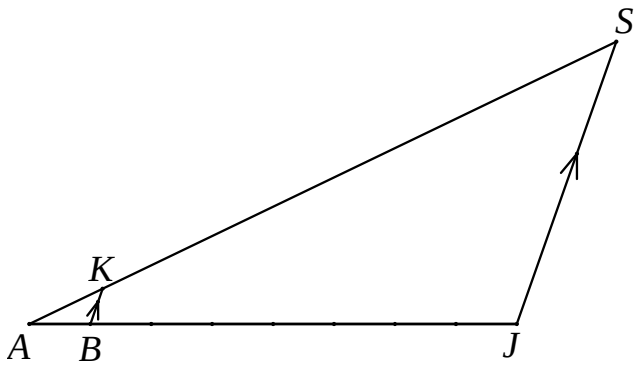
(c) (i) Evaluate $\lim_{x\to 0}\left(\frac{sinx}{x}\right)$ **1**

(ii) Using Simpsons Rule using 5 function values evaluate (to 4 decimal places) **4**

$\int_0^1 xcosecx\ dx.$

(d) (i) Given *BK//JS* prove $\Delta ABK \,|||\, \Delta AJS$. **2**

(ii) Hence deduce that $BK = \frac{AB.JS}{AJ}$, giving reasons. **1**



(iii) In ΔAJS , *AJ* is divided into 8 equal intervals such that *AB=BC=CD=DE=EF=FG=GH=HJ*.
Intervals *BK*, *CL*, *DM*, *EN*, *FP*, *GQ* and *HR* are drawn parallel to *JS* in ΔAJS , as shown. **2**
If *JS= 10*cm find the value of the length *BK+CL+DM+EN+FP+GQ+HR+JS.*

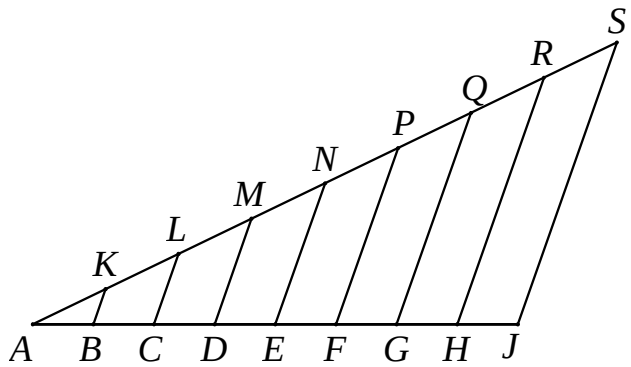


Diagram not to scale

Question 4 (Start A New Page) **Marks**

(a) The sum S of terms in an infinite series is given by **:** **2**

$$S = 1 + 2x + 4x^2 + 8x^3 + \ldots\ldots$$

Find an expression for the sum to infinity, stating the restrictions on x.

(b) $ABCD$ is a square with BC =145 cm. Intervals AH, BE, CF and DG are drawn to form square $EFGH$.

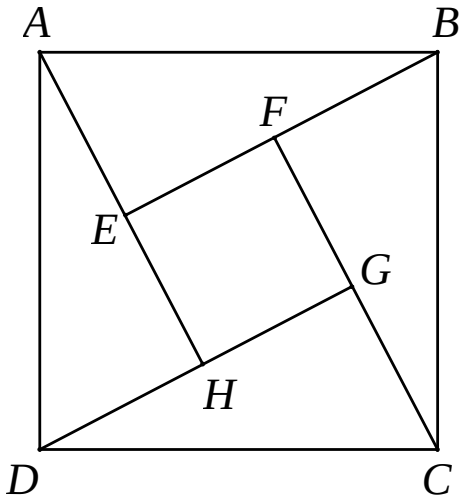


Diagram not to scale

(i) Prove $\Delta ABE \equiv \Delta BCF$. (Hint: Let $\angle ABE = x°$). **4**

(ii) Find the length of CF when BF= 17 cm. **1**

(iii) Find the area of square $EFGH$ **2**

(c) A man obtains a monthly reducible loan of $ 200 000 over 25 years, at an interest rate of 8% p.a.

(i) Show that the amount owing A_n after n monthly repayments of R is : **2**

$$A_n = 200000\left(\frac{151}{150}\right)^n - 150R\left(\left(\frac{151}{150}\right)^n - 1\right)$$

(ii) Find the monthly repayment R. **1**

(iii) Find the amount owing after 15 years if $R is paid each month. **1**

(iv) After 15 years the man changes his repayment to $1600 each month. Find the number of repayments needed to repay the loan. **2**

End of Examination