1. For a curve \( \mathbf{r}(t) \), \( s = \int_0^t |\mathbf{r}'(\tau)|d\tau \), \( \frac{ds}{dt} = |\mathbf{r}'(t)|, \quad ds = |\mathbf{r}'(t)|dt \)

2. \( T = \frac{\mathbf{r}'}{|\mathbf{r}'|}, \quad N = \frac{T'}{|T'|}, \quad B = T \times N \)

3. \( \kappa = \frac{|f''(x)|}{[1 + (f'(x))^2]^{3/2}}, \quad \kappa N = \frac{dT}{ds} \)

4. For \( y = f(x) \), \( \kappa(x) = \frac{|f''(x)|}{[1 + (f'(x))^2]^{3/2}} \)

5. Green’s theorem: \( \int_C Pdx + Qdy = \iint_D (Q_x - P_y) dA \)

6. For a surface \( S \) given by \( \mathbf{r}(u,v) : D \to \mathbb{R}^3 \), the surface area is \( \int_S dS = \iint_D |\mathbf{r}_u \times \mathbf{r}_v| dudv \)

7. For a graph \( S \) given by \( z = f(x,y) \), \( (x,y) \in D \), the surface area is \( \int_S dS = \iint_D \sqrt{1 + f_x^2 + f_y^2} dxdy \)

8. For a surface of revolution \( S : r = f(z) \), \( a \leq z \leq b \), the surface area is \( \int_S dS = \int_a^b 2\pi f(z)\sqrt{1 + [f'(z)]^2} dz \)

Rules for Exams

1. Bring a photo ID for the inspection of the invigilator.

2. During the exam, people may be relocated, for many possible reasons.

3. From five minutes before the end of the exam, you cannot hand in your exam any more and should wait in your seat until the end of the exam.

4. When the invigilator says that the exam is over, you should **stop writing and remain seated.** Please pass your exam to the nearest aisle.

5. Do not discuss before you leave the room, since your neighbor may change her/his solutions after hearing your conversation.

6. You are not allowed to leave until the invigilator has collected all exams and says that you can leave.