<u>exercise 1</u>:
2.2.A: a, b,d.

<u>exercise 2</u>:
2.6.A

<u>exercise 3</u>:
For $t > 0$, define the parametric curve $C$ by $x(t) = t - \ln t$, $y(t) = t^{\frac{1}{2}} + \cos(\frac{\pi}{2}t)$.
(i). Find an equation of the tangent line through $P_0 = (1, 1)$.
(ii). Show that $x$ is a function of $y$ on $C$ near $P_0$.

<u>exercise 4</u>:
Let $\mathcal{C}$ be the curve defined by $x = e^t + e^{-t}$, $y = e^t - e^{-t}$, $-1 \leq t \leq 1$.
(i). Show that $\mathcal{C}$ is a piece of hyperbola and sketch it.
(ii). Compute $\dfrac{d^2x}{dy^2}$ as a function of $t$ and infer the concavity of $\mathcal{C}$ .

<u>exercise 5</u>:
Find the arclength of $\mathcal{C}$ defined in exercise 4. Leave your final answer in integral form.

<u>exercise 6</u>:
Compute the curvature radius at each point of the parabola with equation $y = x^2$. Does this radius achieve a minimum value or a maximum value?

<u>exercise 7</u>:
For the vector $u = (u_1, u_2)$ we define the vector
$R_\theta u = (\cos\theta\, u_1 - \sin\theta\, u_2, \sin\theta\, u_1 + \cos\theta\, u_2)$. Let $e_1 = (1, 0)$, $e_2 = (0, 1)$.
(i). For $\theta = \dfrac{\pi}{2}$, find and sketch $R_\theta e_1$ and $R_\theta e_2$.
(ii). For any two vectors $u, v$ in $\mathbb{R}^2$, show that $u \cdot v = R_\theta u \cdot R_\theta v$.
(iii). Let $\mathcal{C}$ be the parametric curve defined by $(x(t), y(t))$, $t \in [a, b]$ where $x$ and $y$ are $C^1$ functions of $t$. Let $\mathcal{C}_\theta$ be the parametric curve defined by $(R_\theta x(t), R_\theta y(t))$, $t \in [a, b]$. Show that $\mathcal{C}$ and $\mathcal{C}_\theta$ have the same arc length.