

Local approximation to linear ODEs

Please hand in questions 1(a) and 2(a) on Thursday 10 February 2025 at 12pm

1. Find the leading behaviours as $x \rightarrow 0^+$ of the following equations

$$(a) x^4 y''' = y$$

$$(b) y'' = (\cot x)^4 y \quad (\text{hint: } \cot x \sim 1/x - x/3 + \dots \text{ as } x \rightarrow 0)$$

$$(c) x^4 y''' - 3x^2 y' + 2y = 0$$

$$(d) y'' = \sqrt{xy}$$

$$(e) x^5 y''' - 2xy' + y = 0$$

2. Find the leading behaviours as $x \rightarrow +\infty$ of the following equations

$$(a) xy''' = y'$$

$$(b) y'' = \sqrt{xy}$$

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