Q1 c)

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<< Notation`
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Symbolize[$x_{t+\Delta t}$]

Symbolize[$\dot{x}_{t+\Delta t}$]

Symbolize[$\ddot{x}_{t+\Delta t}$]

Symbolize[$x_{t+\gamma\Delta t}$]

Symbolize[$\dot{x}_{t+\gamma\Delta t}$]

Symbolize[$\ddot{x}_{t+\gamma\Delta t}$]

Symbolize[x_t]

Symbolize[$\dot{x}_t$]

Symbolize[$\ddot{x}_t$]

Symbolize[$r_{t+\Delta t}$]

Symbolize[$r_{t+\gamma\Delta t}$]

Symbolize[Ω_o]

Symbolize[$\overline{\Omega}_d$]

Symbolize[$\overline{\xi}$]

Symbolize[β_1]

Symbolize[β_2]

Symbolize[X_t]

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ClearAll["Global`*"]
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$$\alpha = \frac{-\delta\left(6\,\delta\,\gamma^2 - 12\,\delta\,\gamma - 3\,\gamma + 4\right)}{6\,\gamma\left(2\,\delta\,\gamma - 1\right)};$$

$$\beta = \delta\left(\Omega^2\,\alpha\,\gamma^2 + 1\right)^2;$$

$$A_1 = \frac{1}{\beta}\left(\left(\left(\left(\frac{1}{4}\right)\delta^3 + \left(-\alpha\,\gamma + \left(\frac{1}{8}\right)\right)\delta^2 + \alpha\left(\alpha\,\gamma^2 - \left(\frac{\gamma}{2}\right) - \left(\frac{1}{4}\right)\right)\delta + \left(\frac{\alpha}{8}\right)\right)\gamma^2\,\Omega^4 + \left(\frac{1}{8}\right)\left(16\,\alpha\,\gamma^2 - 4\right)\delta\,\Omega^2 + \delta\right);$$

$$A_2 = \frac{1}{\beta}\left(\left(2\,\delta^3\,\gamma^2 + \left(-8\,\alpha\,\gamma^3 + 3\,\gamma^2 - 4\,\gamma\right)\delta^2 + \left(4\,\alpha^2\,\gamma^4 - 4\,\alpha\,\gamma^3 + 10\,\alpha\,\gamma^2 - \gamma + 1\right)\delta + \gamma\,\alpha\left(\gamma - 2\right)\right)\Omega^4 + 2\,\Omega^2\,\alpha\,\gamma^2\,\delta + \delta\right);$$

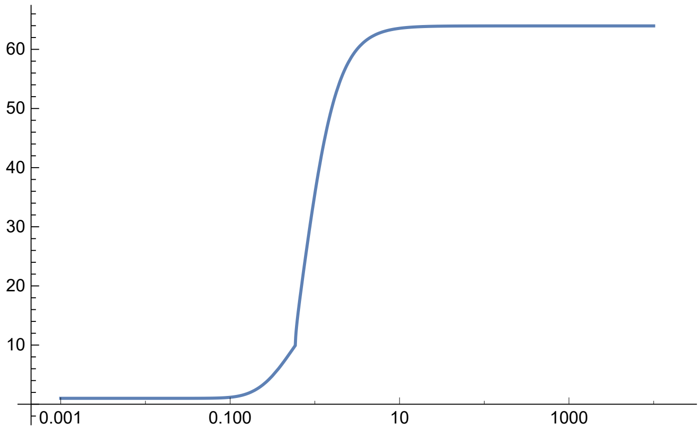
$\delta = 0.3;$

$\gamma = 2.78;$

$\Omega = 2\,\mathrm{Pi}\,p;$

$\lambda 1 = A_1 + \left(A_1{}^2 - A_2\right)^{1/2};$

$\mathrm{spR} = \mathrm{LogLinearPlot}\left[\mathrm{Abs}[\lambda 1],\ \left\{p,\ 10^{-3},\ 10^4\right\}\right]$



$$\mathrm{pe} = \frac{\Omega}{\mathrm{qq}} - 1$$

$$-1 + (2\,p\,\pi) \Big/ \mathrm{ArcTan}\left[\left(0.3\,\left(1 + 3.58889\,p^2\right)^2 \sqrt{\left(-\left(\left(11.1111\,\left(0.3 - 3.76843\,p^2 + 133.228\,p^4\right)^2\right) \Big/ \left(1 + 3.58889\,p^2\right)^4\right) + \left(3.33333\,\left(0.3 + 2.15333\,p^2 + 1234.55\,p^4\right)\right) \Big/ \left(1 + 3.58889\,p^2\right)^2\right)}\right) \Big/ \left(0.3 - 3.76843\,p^2 + 133.228\,p^4\right)\right]$$

$$-1 + \frac{2\,p\,\pi}{\mathrm{qq}}$$

$$-1 + (2\,p\,\pi) \Big/ \mathrm{ArcTan}\left[\left(0.3\,\left(1 + 3.58889\,p^2\right)^2 \sqrt{\left(\left(11.1111\,\left(0.3 - 3.76843\,p^2 + 133.228\,p^4\right)^2\right) \Big/ \left(1 + 3.58889\,p^2\right)^4 - \left(3.33333\,\left(0.3 + 2.15333\,p^2 + 1234.55\,p^4\right)\right) \Big/ \left(1 + 3.58889\,p^2\right)^2\right)}\right) \Big/ \left(0.3 - 3.76843\,p^2 + 133.228\,p^4\right)\right]$$

$$\mathrm{qq} = \mathrm{ArcTan}\left[\frac{\left(-A_1{}^2 + A_2\right)^{1/2}}{A_1}\right]$$

$$\mathrm{ArcTan}\left[\left(0.3\,\left(1 + 3.58889\,p^2\right)^2 \sqrt{\left(-\left(\left(11.1111\,\left(0.3 - 3.76843\,p^2 + 133.228\,p^4\right)^2\right) \Big/ \left(1 + 3.58889\,p^2\right)^4\right) + \left(3.33333\,\left(0.3 + 2.15333\,p^2 + 1234.55\,p^4\right)\right) \Big/ \left(1 + 3.58889\,p^2\right)^2\right)}\right) \Big/ \left(0.3 - 3.76843\,p^2 + 133.228\,p^4\right)\right]$$

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Plot[(pe) * 100, {p, 0, .5}]
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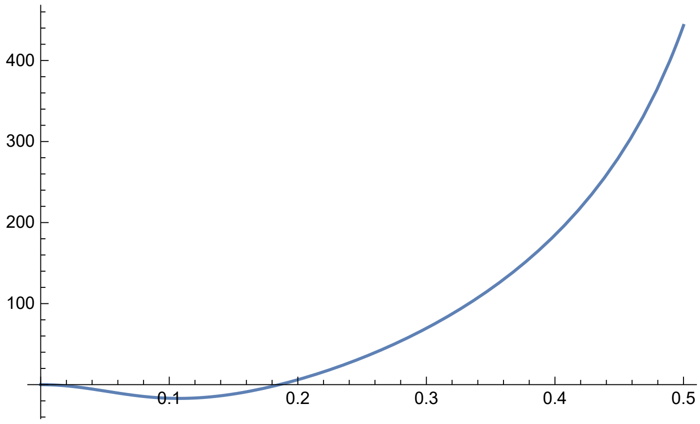

$$\texttt{ee} = -\frac{1}{\Omega}\,\texttt{Log[Abs[}\lambda\texttt{1]]}$$

$$-\frac{1}{2\,p\,\pi}\mathrm{Log}\Big[\mathrm{Abs}\Big[\left(3.33333\,\left(0.3-3.76843\,p^{2}+133.228\,p^{4}\right)\right)\Big/\left(1+3.58889\,p^{2}\right)^{2}+\sqrt{\left(\left(11.1111\,\left(0.3-3.76843\,p^{2}+133.228\,p^{4}\right)^{2}\right)\Big/\left(1+3.58889\,p^{2}\right)^{4}-\left(3.33333\,\left(0.3+2.15333\,p^{2}+1234.55\,p^{4}\right)\right)\Big/\left(1+3.58889\,p^{2}\right)^{2}\right)}\Big]\Big]$$

$$\texttt{AD} = 1 - \mathrm{Exp}\left[-2\,\mathrm{Pi}\,\mathrm{ee}\,\frac{\Omega}{qq}\right]$$

$$1-\mathrm{Abs}\Big[\left(3.33333\,\left(0.3-3.76843\,p^{2}+133.228\,p^{4}\right)\right)\Big/\left(1+3.58889\,p^{2}\right)^{2}+\sqrt{\left(\left(11.1111\,\left(0.3-3.76843\,p^{2}+133.228\,p^{4}\right)^{2}\right)\Big/\left(1+3.58889\,p^{2}\right)^{4}-\left(3.33333\,\left(0.3+2.15333\,p^{2}+1234.55\,p^{4}\right)\right)\Big/\left(1+3.58889\,p^{2}\right)^{2}\right)}\Big]^{\frac{2\pi}{\mathrm{ArcTan}\left[\frac{0.3\,\left(1+3.58889\,p^{2}\right)^{2}\sqrt{-\frac{11.1111\,\left(0.3-3.76843\,p^{2}+133.228\,p^{4}\right)^{2}}{\left(1+3.58889\,p^{2}\right)^{4}}+\frac{3.33333\,\left(0.3+2.15333\,p^{2}+1234.55\,p^{4}\right)}{\left(1+3.58889\,p^{2}\right)^{2}}}}{0.3-3.76843\,p^{2}+133.228\,p^{4}}\right]}}$$

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Plot[(AD) * 100, {p, 0, .2}]
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