

Problem 8.27 Discuss the convexity of the following functions:

(i) $f(x) = (x-2)x^{2/3}$; (ii) $f(x) = |x|e^{|x|}$; (iii) $f(x) = \log(x^2 - 6x + 8)$.

Problem 8.28

(i) Sketch the graph of the function $f(x) = x + \log|x^2 - 1|$.

(ii) Based on the previous graph, plot function $g(x) = |x| + \log|x^2 - 1|$ and $h(x) = |x + \log|x^2 - 1||$.

Problem 8.29 Sketch a plot of the following functions:

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| (i) $f(x) = e^x \sin x$; | (vi) $f(x) = (x^2 - 1) \log\left(\frac{1+x}{1-x}\right)$; |
| (ii) $f(x) = \sqrt{x^2 - 1} - 1$; | (vii) $f(x) = \frac{x}{\log x}$; |
| (iii) $f(x) = xe^{1/x}$; | (viii) $f(x) = \frac{x^2 - 1}{x^2 + 1}$; |
| (iv) $f(x) = x^2 e^x$; | (ix) $f(x) = \frac{e^{1/x}}{1-x}$; |
| (v) $f(x) = (x-2)x^{2/3}$; | (x) $f(x) = \log[(x-1)(x-2)]$; |
| (x) $f(x) = \log[(x-1)(x-2)]$; | (xi) $f(x) = \frac{e^x}{x(x-1)}$; |
| (xi) $f(x) = \frac{e^x}{x(x-1)}$; | (xii) $f(x) = 2 \sin x + \cos 2x$; |
| (xii) $f(x) = 2 \sin x + \cos 2x$; | (xiii) $f(x) = \frac{x-2}{\sqrt{4x^2+1}}$; |
| (xiii) $f(x) = \frac{x-2}{\sqrt{4x^2+1}}$; | (xiv) $f(x) = \sqrt{ x-4 }$; |
| | (xv) $f(x) = \frac{1}{1+e^x}$; |
| | (xvi) $f(x) = \frac{e^{2x}}{e^x - 1}$; |
| | (xvii) $f(x) = e^{-x} \sin x$; |
| | (xviii) $f(x) = x^2 \sin \frac{1}{x}$. |

Problem 8.30 Draw the graph of the following functions:

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| (i) $f(x) = \min\{\log x^3 - 3 , \log x + 3 \}$; | (iv) $f(x) = x\sqrt{x^2 - 1}$; |
| (ii) $f(x) = \frac{1}{ x -1} - \frac{1}{ x-1 }$; | (v) $f(x) = \arctan \log x^2 - 1 $; |
| (iii) $f(x) = \frac{1}{1+ x } - \frac{1}{1+ x-a }$, ($a > 0$); | (vi) $f(x) = 2 \arctan x + \arcsin\left(\frac{2x}{1+x^2}\right)$. |

Problem 8.31 Plot the function

$$f(x) = \begin{cases} \frac{e^{1/x}}{1+x}, & x \neq 0, \\ 0 & x = 0, \end{cases}$$

and discuss how many real solutions has the equation $\frac{e^{1/x}}{1+x} = x^3$.

Problem 8.32 Given the function $f(x) = \frac{1+x}{3+x^2}$ plot the functions $g(x) = \sup_{y>x} f(y)$ and $h(x) =$

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