mock exam math 100

29 November 2019

question 1 [10 points] Let $f(x) = x^4 - 2x^3 + 1$. To answer the following questions, you might find it helpful to first draw a sketch of the function $f(x)$.

(a) Find the x-coordinates of **all** ...

- ...critical points: [1 point]
- ...local minima: [1 point]
- ...local maxima: [1 point]
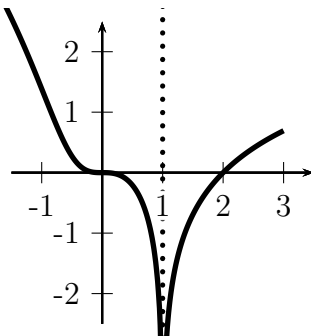- ...inflection points: [1 point]

If no such points exist, answer "none". You do not need to justify your answers for this part.

(b) How many real roots does $f(x)$ have? Justify your answer!   [3 points]
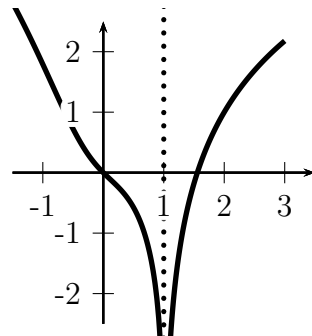
(c) Which of the following graphs shows $\log(f(x))$? You do not need to justify your answer for this part of the question.   [3 points]
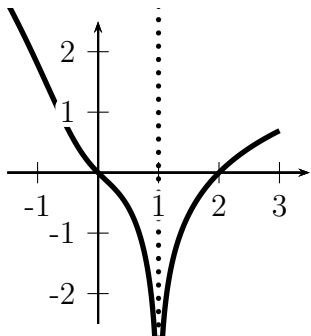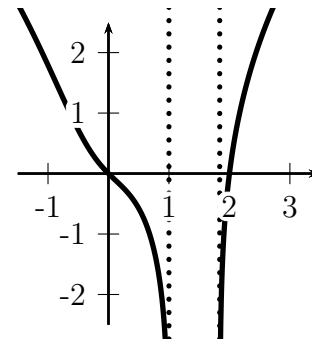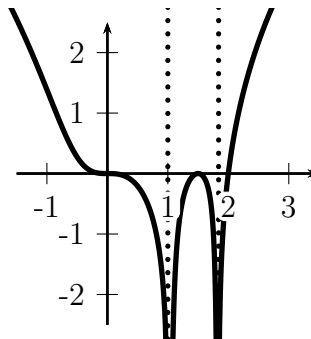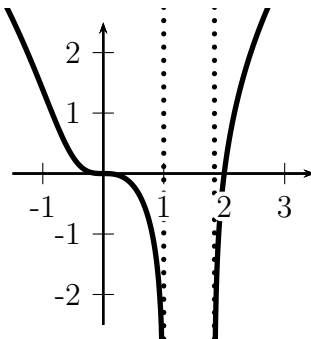

(a)

(b)

(c)

(d)

(e)

(f)

question 2 [5 points] Find all solutions of $\sqrt{3}\cos(x) - \sin(x) = 1$. (*Hint: What is a solution of* $\cos(x) = \frac{\sqrt{3}}{2}$ *?*)

question 3 [5 points] Find the antiderivative of the function $y = x \cdot e^{1-x^2}$ which passes through the origin $(0,0)$.

question 4 [5 points] If

$$f(x) = \arctan(x) - \arctan\left(\frac{x-1}{x+1}\right),$$

find $f'(x)$. Hence, or otherwise, find a simple expression for $f(x)$.