1K03E Sample Exam Questions

Amalgamated from previous years' practice exams

(Note this is NOT in the same format/length as our exam. See course website for details and layout of the upcoming examination)

1. Suppose a culture of bacteria is growing exponentially. There are 3000 bacteria at 2PM and 4000 at 4PM.

a) How many bacterium are there at 5pm?

b) What is the doubling time for this culture?
(That is: how long does it take the population to double)

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2. Find:

$$\lim_{x \to -\infty} \frac{x^2}{e^{-x}}$$

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3. Find the derivatives of the following functions:

a) $h(t) = \dfrac{1 + e^{2t}}{1 - e^{t^2}}$ **b)** $f(x) = \ln\left((2x+1)(x^2+2)\right)$

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4. How long would it take a $1000 investment to double in value if it grew at 6% per year, compounded monthly?

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5. Solve for x.

a) $\left(\left(x^{1/2}\right)\left(x^{3/2}\right)\right)^2 = 81$ **b)** $\log_5 x = 3$ **c)** $(1.35)^{4x} = 20$

6. Graph the given function, finding domain, *y*-intercept, *x*-intercepts, asymptotes, critical points, intervals of increase/descrease, relative max/min, intervals of concavity and inflection points.

$$f(x) = \frac{x}{\ln x}$$

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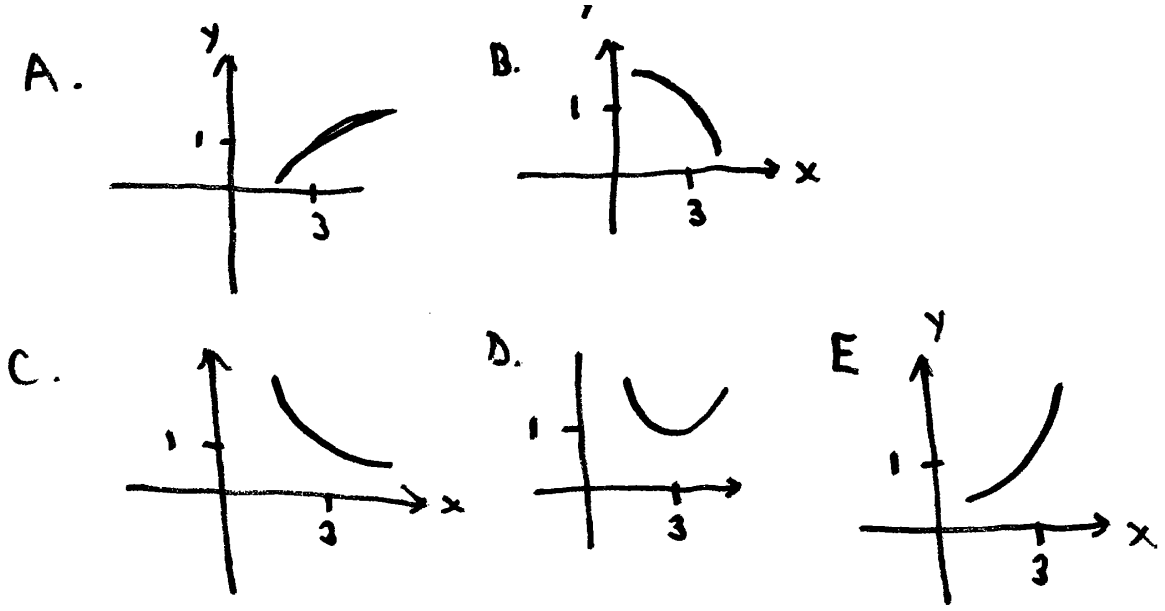
7. Suppose that $f(3)=1$, $f'(3)=-2$, and $f''(3)=4$. Which of the following graphs best represent $y=f(x)$ close to $x=3$?



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8. Find the absolute extreme values (absolute extrema) of:

$$p(x) = x^3 + x^2 - 2x + 1$$

on the interval [-1,2].

9. Find the domain of the following functions:

a) $\dfrac{\sqrt{4-2x}}{x^2-1}$ **b)** $\dfrac{1}{x^2+3x-4}$

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10. Calculate the following limits:

a) $\lim_{x\to 2} x^3-2x+3$ **b)** $\lim_{x\to -2} \dfrac{x^2-2x-8}{x+2}$ **c)** $\lim_{x\to \infty} \dfrac{7x^3-2x^2+1}{2x^3-6x}$

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11. Find $f(g(x))$:

$$f(x)=x^2-1 \qquad g(x)=x+\frac{1}{x}$$

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12. Where is the given function decreasing:

$$f(x)=3x^2+6x$$

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13. Where does the given function have an inflection point:

$$G(x)=3x^2-12x+3$$

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14. Where is the given function concave up?

$$F(x)=x^4-6x^2+3$$

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15. Find the derivative of:

$$H(x)=\sqrt{1+\sqrt{x}}$$

at $x=9$.

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16. Find all the relative max and min of the function:

$$G(x)=2x^2+7x-15$$