

# Final Answers

## MATH104 December 2010

April 4, 2015

### How to use this resource

- When you feel reasonably confident, simulate a full exam and grade your solutions. [For your grading you can get the full solutions here.](#)
- If you're not quite ready to simulate a full exam, we suggest you thoroughly and slowly work through each problem. Use this document with the final answers only to check if your answer is correct, without spoiling the full solution.
- Should you need more help, check out the hints and video lecture on the [Math Education Resources](#).

### Tips for Using Previous Exams to Study: Work through problems

*Resist the temptation to read any of the final answers below before completing each question by yourself first! We recommend you follow the guide below.*

1. **How to use the final answer:** *The final answer is not a substitution for the full solution!* The final answer alone will not give you full marks. The final answer is provided so that you can check the correctness of your work without spoiling the full solution.
  - To answer each question, only use what you could also use in the exam. [Download the raw exam here.](#)
  - If you found an answer, how could you verify that it is correct from your work only? E.g. check if the units make sense, etc. Only then compare with our result.
  - If your answer is correct: good job! Move on to the next question.
  - Otherwise, go back to your work and check it for improvements. Is there another approach you could try? If you still can't get to the right answer, you can check the full solution on the [Math Education Resources](#).
2. **Reflect on your work:** Generally, reflect on how you solved the problem. Don't just focus on the final answer, but whether your mental process was correct. If you were stuck at any point, what helped you to go forward? What made you confident that your answer was correct? What can you take away from this so that, next time, you can complete a similar question without any help?
3. **Plan further studying:** Once you feel confident enough with a particular topic, move on to topics that need more work. Focus on questions that you find challenging, not on those that are easy for you. Once you are ready to tackle a full exam, follow the advice for the [full exam \(click here\)](#).

Please note that all final answers were extracted automatically from the full solution. It is possible that the final answer shown here is not complete, or it may be missing entirely. In such a case, please notify [mer-wiki@math.ubc.ca](mailto:mer-wiki@math.ubc.ca). Your feedback helps us improve.

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### Question 1 (a)

FINAL ANSWER. This is our answer.

### Question 1 (b)

FINAL ANSWER.  $\lim_{x \rightarrow \infty} f(x) = 3$ .

### Question 1 (c)

FINAL ANSWER. "A calculator would tell you that  $t$  is about 1.54 years."

### Question 1 (d)

FINAL ANSWER. On an exam, either answer,  $(10, \infty)$  or  $[10, \infty)$ , would be acceptable.)

### Question 1 (e)

FINAL ANSWER.  $\lim_{x \rightarrow 3} \frac{x^2 - 3x}{f(3) - f(x)} = -\frac{3}{5}$

### Question 1 (f)

FINAL ANSWER.  $\frac{1}{f(2)} f'(2) \cdot 2 = -\frac{10}{3}$ . Hence, the slope of the tangent line at  $x = 1$  is equal to  $-10/3$ .

### Question 1 (g)

FINAL ANSWER. Therefore the next approximation to the solution is  $x_1 = 7/4$ .

### Question 1 (h)

FINAL ANSWER. The equation of the tangent line is then  $y - 0 = 1(x - 1)$ , by the point-slope formula, or  $y = x - 1$ .

### Question 1 (i)

FINAL ANSWER. Therefore we have that  $f(x)$  is concave up on  $(0, e)$  and concave down on  $(e, \infty)$ .

### Question 1 (j)

FINAL ANSWER.  $\left. \frac{dy}{dt} \right|_{x=1, y=2} = -\frac{3}{4}$  and so we conclude that the  $y$ -coordinate is changing at  $-3/4$  kilometers per minute at that moment.

### Question 1 (k)

FINAL ANSWER. In comparing these we find the global maximum is 4 occurring at  $x = 8$  and the global minimum is 0 occurring at  $x = 0$ .

### Question 1 (l)

FINAL ANSWER. If  $x = \pi$  is a critical point then  $2a \cos(2\pi) + \cos(\pi) - \pi \sin(\pi) = 0$  so  $a = 1/2$ .

### Question 1 (m)

FINAL ANSWER.  $c_3 = \frac{8e}{6}$ .

### Question 1 (n)

FINAL ANSWER.  $\ln(0.8) \approx \ln(1) + 1(0.8 - 1) = -0.2$

### Question 2 (a)

FINAL ANSWER.  $y - 2 = \frac{-7}{16}(x - 1)$ .

### Question 2 (b)

FINAL ANSWER. Making a linear approximation, we conclude that the point on the *curve* with y-coordinate  $31/16$  is approximately the same as the point on the *tangent line* with y-coordinate  $31/16$ . Hence, the x-coordinate of the point on the curve with y-coordinate  $31/16$  is approximately  $8/7$ .

### Question 3

FINAL ANSWER.  $-\frac{3}{2} \frac{3(3)^2+1}{6(2)^2+2(2)} = -\frac{3}{2}$ .

### Question 4

FINAL ANSWER. Hence, the company should produce 1000 kg of chemical in order to minimize its average cost.

### Question 5

FINAL ANSWER.  $P'(q) = -\frac{100}{q+5}(q+4)(q-3)$  This is equal to zero when  $q$  is equal to 3 or -4, but only 3 lies in the domain of interest. Although it is not necessary, it is easy to check that the profit is actually maximized when  $q = 3$  because when  $q < 3$ ,  $P'(q) > 0$ , and when  $q > 3$ ,  $P'(q) < 0$ . (Hence, the profit function is increasing when  $q < 3$  and decreasing when  $q > 3$ .) Therefore, the profit is maximized when 3 jackets are sold per month. Also, notice that taking the derivative of profit and setting it to zero, is equivalent to finding the point at which the marginal profit is zero or when the marginal revenue is equal to the marginal cost

### Question 6

FINAL ANSWER. Therefore, the price of the stock is increasing most rapidly when  $t=0$ .