

Math 111
Autumn 2001
Exam I - Solutions

Some questions require you to approximate values from a graph. In these cases, we accept answers from a range of values.

1. (a) The overall rate of change at 2 p.m. is

$$\frac{\text{total change in temp}}{\text{total change in time}} = \frac{60^\circ - 23^\circ}{120 \text{ min}} = \frac{37^\circ}{120 \text{ min}} = 0.31^\circ \text{ per min.}$$

We would accept any answer between 0.29 and 0.33.

NOTE: While we would allow some error in estimating the temperature at $t = 120$, the temperature at $t = 0$ is given in the problem as 23° .

- (b) The incremental rate of change from 1:30 to 3:30 is

$$\frac{\text{change in temp}}{\text{change in time}} = \frac{69^\circ - 54^\circ}{120 \text{ min}} = \frac{15^\circ}{120 \text{ min}} = 0.125^\circ \text{ per min.}$$

We would accept any answer between 0.10 and 0.15.

- (c) Statement (ii) is true.
(d) The overall rate of change in the temperature at 1:30 is greater than the incremental rate of change in the temperature from 1:00 to 1:30.
(e) Any thirty-minute interval that begins at or after $t = 45$ minutes would be acceptable.

2. Note that the graph gives the CHANGE in stock price over each day.

- (a) On day 9, the stock was \$5.35. According to the price-change graph, the price decreased by \$0.02 from day 8 to day 9. So, on day 8, the stock was \$5.37. On day 10, the stock was $\$5.35 - 0.12 = \5.23 . On day 11, the price of the stock was $\$5.23 + 0.03 = \5.26 .
(b) Either day 2 or day 12 is correct.
(c) According to the price-change graph, the price went up by \$0.12 from day 5 to day 6. So, the price was higher on day 6.

3. (a) We would accept anything greater than 300 and less than 325.
(b) We would accept anything greater than or equal to 150 and less than 175.
(c) The total cost of producing 500 grabticks is something between 450 and 475. The variable cost of producing 500 grabticks would then be between $450 - FC$ and $475 - FC$. For example, if you said that $TC(500) = 460$ and $FC = 150$, then $VC(500) = 310$.

- (d) The breakeven price is the slope of the line that is both a diagonal line to the TC graph and a tangent line to the TC graph. This line touches the graph of TC when q is approximately 420 and TC is approximately \$350. The slope of this line is approximately 0.83.
- (e) We're looking for the value of q where the line you drew in part (d) touches the TC graph. This should be somewhere around $q = 420$. We would accept answers greater than 400 and less than 450.
- (f) Reading from the graph of AVC , the average variable cost of producing 300 grabticks is about \$0.55 per grabtick. We would accept answers greater than \$0.50 and less than or equal to \$0.5625.
- (g) The smallest value of AVC occurs where the AVC graph crosses the MC graph. The height of the graphs at this point of intersection is about \$0.47. We would accept answers greater than or equal to \$0.4375 and less than \$0.50.
- (h) The shutdown price is the smallest value of AVC . Your answer here should be the same as your answer to part (g).