The answers in the back of the book are not adequate in Section 2.4. If you give answers like that on the exam, you will not get many points. UNITS are crucial, as is the word APPROXIMATELY where appropriate. You should also use complete, jargon-free sentences. Avoid the word “rate”…the point is to explain what the rate means in plain english.

1). a. The cost of producing 200 gallons is $1,300.
   b). If we are already producing 200 gallons, it will cost approximately $6 more dollars to produce one more gallon.
   Or: It will cost about an extra $6 to produce 201 gallons rather than 200 gallons.

3. a). The sign of $f'$ is positive because the temperature $f$ is increasing.
   b). degrees F per minute.
   After 20 minutes, the yam is still heating up…its temperature will increase approximately 2 degrees F over the next minute. OR: Between 20 and 21 minutes, the yam’s temperature increases about 2 degrees F.

5.a). It costs $600 to produce 200 quarts of ice-cream (units of 600 are dollars, units of 200 are quarts.)
   b). It costs only about $2 more to produce another quart of ice-cream once we have produced 200 quarts (units of $f’(200)$ are dollars per quart).

7. Units of $C'(r)$ are dollars per percentage annual rate. $C'(r)$ tells us the growth of our debt as a function of the interest rate. $C'(r)$ is likely positive, because the cost is higher when we borrow money at a higher interest rate. For example, if our interest rate is currently $r\%$, $C'(r)$ is roughly the additional amount we’d owe if the interest rate rises to $r + 1$ percent annually.
9. $P'(t)$ is measured in units of dollars per year. It is negative, since if we take more
years to pay off the mortgage, each monthly payment should be less since there are
more of them. $P'(t)$ tells us **Approximately** how much less we would pay each
month, if we decide to take one more year to pay it off instead of paying it off in $t$
years.

11. Investing $1000 at an annual interest rate of 5% compounded continuously for ten
years will produce a balance of about $1649. That $g'(5) = 169$ (measured in dollars
per annual percentage rate) tells us that if we invest the same $1000 at 6% instead of
5% (both compounded continuously for ten years), we can expect to earn about $165
more. **Note:** As stated, this will be accepted as correct on the exam, however if you
are a critical thinker and wise investor, you know that there is a pretty big difference
between 5% and 6%...it is not really “a small change in input” indeed it is a twenty
percent change in the units of ”percent rate”. A wiser interpretation would be “If we
invest the same $1000 at 5.1% instead of 5% (both compounded continuously for ten
years), we can expect to earn **about** $16.5$ more” or even better, “If we invest the
same $1000 at 5.01% instead of 5% (both compounded continuously for ten years),
we can expect to earn about $1.65$ more.” **Note** that in all cases the rate of change
is the same: $169$ $/\text{interest rate}$, since $165/1 = 16.5/1 = 1.65/.01$ $/\text{rate}$, but we
making successively safer (more likely to be accurate) estimates as we take smaller
increases in $h$.

13. a). $f(1800) = 155$: A person consuming 1800 calories a day will weigh about
155 pounds.

$b'\left(2000\right) = 0$: A person’s weight will stay stable if she consumes about 2000
calories a day.

$c^{-1}(162) = 2200$: A person weighing 162 pounds consumes about 2200 calories a
day.

b). Units of $dW/dc$ are pounds per daily calories or pounds per (calories/day).

17. At a price of $10 each, about 240,000 items are sold. If the price goes up one
dollar, roughly 29,000 fewer will sell.

19. a). The population of Mexico increased by roughly 2 million people between

b). The population hit 95.5 million in 1996.

c). The population climbed from 95.5 million to 96 million in roughly 3 months.
**Note:** you could also say the population increased by 1 million in roughly .46 years,
but this rate is the same as by half a million in .23 years, which is about 3 months.
21. a). After 5 hours, the depth of the water is 3 feet.

b). Between 5 and 6 hours, the water depth rises by roughly .7 feet. [Note: since here the difference in inputs $h = 1$ is not so small relative to the problem, we might want to add “This assumes there is no dramatic change in the water flow during that time.”] Another possibility: Between 5 hours and 5 hours 5 minutes, the water rises by 3 inches. Note that 3 ft/hour $= 36$ inches/hour $= 3/5$ inch/minute.

23. $g'(t)$ is measured in height per year. $g'(10)$ is positive, because she is growing at age 10. $g'(30)$ is likely zero: she is too old to grow, too young to shrink.

25. $dP/dt$ is measured in barrels/year. This function describes the change in the oil reserves over time. Its sign is negative, since oil is being used but not created. To estimate its value, say in 2013, we could approximate it by figuring out how many barrels of petroleum are used in 2013, since that would be the change in $P$ over the unit of time (Jan 1 2013-Jan 1 2014). That would give us (roughly) the value to $dP/dt$ in the year 2013. Or we could take any other interval reasonably closely approximating 2013, say 2012-2014, or 2013-2014, depending on what data we have.

27. $dW/dt$ is measured in gallons per minute. It tells us how fast the tub is filling or emptying.

b) i) 0, since the tub is full and not yet draining; ii). negative: the gallons are decreasing; iii) 0: nothing is changing.