1.  
   (a) See the graph in your book—exhibit 4.9 or 4.10  
   (b) See the graph in your book—exhibit 4.11  
   
   (c) Price decrease—normal good

A is the original consumer’s choice. When the price decreases, the BC pivots out to the new BC and the new choice is point B. The compensated budget line is a line parallel to the NEW BC and tangent to the OLD IC—in this case, we could think about how much money we could take away from consumers who face the new low prices and keep them as happy as they were originally. If we did that, their choice would be point C. The difference between point C and Point A is the substitution effect (the original BC and the Comp BC have different slopes). The difference between point C and point B is the income effect (the new BC and the Comp BC have the same slope, but the new BC is “further out” and so represents higher income).
(d) A price decrease and an inferior good. 
Note that this graph looks EXACTLY like the one above with one difference—now x is inferior, so higher income (moving from the Comp BC to the New BC) leads to less of x being purchased—point B is to the left of point C. The Income and substitution effects here go in opposite directions.

2. When price increases, the quantity demanded typically decreases. Give an intuitive explanation (as opposed to a diagram) of the income effect and the substitution effect when the price of a good increases. For simplicity, assume it is a normal good.

*Substitution effect:* the increase $P_x$ means that $x$ is more expensive relative to other goods. Individuals will stop consuming goods whose marginal value is below the new higher price.

*Income effect:* Because the price of $x$ rose, the individual can no longer afford their original bundle. They are no longer as well off; the price change has made them effectively poorer. If $x$ is a normal good, this will reduce their consumption of $x$. 
3. Sharon has 24 hours in a day to divide between work and leisure. Her hourly wage net of taxes is $10.

\[ \text{Price of leisure} = 50 + 19 \times 5 = 145 \]

The blue line represents the original budget constraint. Its slope is -10—the wage. The wage is the opportunity cost of leisure—the price of leisure in terms of dollars foregone that could have been spent on other stuff.

b. Suppose that Sharon is subject to a 50% tax on all income over $50 a day. Draw the new budget constraint.

b. If income and leisure are both normal goods, will she work harder, spend more time enjoying leisure, or can you say? Indicate the income and substitution effects in your diagram.

Can’t say. If her optimal choice was in the part of the budget constraint below $50 of income, her optimal point would not change. If she was above that (as shown in the diagram), we cannot say. The diagram shows a compensated budget line, parallel to the new BC and tangent to the old IC. Her original choice is A, her new choice is B. Her demands on the compensated budget constraint (which we do not observe) are C. The substitution effect will cause her to work less, the income effect will cause her to work more. In the diagram above, I drew the new choice so that the substitution effect was larger (B is to the left of A) but you should also be able to draw this so that the income effect is larger (B is to the right of A).
A is the original choice. B is the new choice. C is the compensated demand. A \(\rightarrow\) C is the substitution effect (only relative prices change), C \(\rightarrow\) B is the income effect (only income changes)

d. Suppose that instead of a tax, the government gives Sharon $10 if her income is less than $50. For example, if her income is $49, the government still gives her $10, but once her income is $50, Sharon receives nothing from the government. Draw the new budget constraint.

The new BC is the solid blue line.

4. George S. Oros has $1000 today and expects to receive $1000 a year from now. His savings account pays an annual interest rate of 25%. The bank is also willing to lend money at the same interest rate.

   a. Suppose that George saves all of your money to spend next year. How much money will he be able to spend today and next year?

   \[ C_0 = 0, \ C_1 = $2250 \]

   b. Suppose that he borrows $800 and spends $1800 today. How much will he be able to spend next year? \[ C_1 = 0 \ (\text{has to pay $200 in interest}) \]
c. Draw a budget constraint with “spending today” on the x-axis and “spending next year” on the y-axis. What is its slope? How does this reflect the relative price of spending today in terms of spending next year? \( \text{Slope} = -1.25 \)—the price of consuming $1 today is forgoing $1.25 tomorrow.

d. Suppose George chooses to neither borrow nor save. Illustrate this optimal point with the budget line with an indifference curve.

e. Suppose that George was neither borrowing nor saving, as in part (d). Now the interest rate rises to 50%. Show how the budget line shifts above. Does George increase or decrease current spending? Does he increase or decrease future spending? Is he better off or worse off? Decreases current, Increases future, better off.

f. For part (e), decompose the change in consumption into an income and a substitution effect.

See below A \(\rightarrow\) C substitution effect, C \(\rightarrow\) B income effect

g. Now suppose instead that George is a saver when the interest rate is 25%. Draw a new diagram with the same budget constraint and a new indifference curve that illustrates this. Again assume the interest rate rises to 50%. Will George increase or decrease current spending or can you say? Illustrate the income and substitution effects for a saver.
Essentially the same picture, except that the original tangency point A is to the left along the black BC. (Co<1000) The new tangency may be either to the right or to the left of point A. This means George may either save more or less. Why? The substitution effect comes from the fact that the price of consumption today has gone up—if he saves an extra dollar, he will have $1.50 next year instead of $1.25. But—because he is a saver, an increase in the interest rate makes him effectively richer. As a result of the higher interest rate, he won’t have to save as much to achieve his same standard of living. (For example, suppose he had some target level of C1—say enough next year for a new car. With a higher r, he won’t have to put aside as much to reach his same goal.) The net result is that we don’t know if a saver will save more or less as a result of a change in r.