

Computing Car Insurance

SUBMITTED BY: Nina Hoe, University of Pennsylvania

SUBJECT(S): Computation

GRADE LEVEL(S): 9, 10, 11, 12

OVERVIEW:

In this lesson, students will compute car insurance rates for different scenarios.

RELATED ARTICLES:

- [“New Car? The Costs Start Here”](#)
- [“Driver Alert: Car Insurance Will Cost You”](#)
- [“Career Spotlight: Inside Actuarial Science”](#)

Common Core Standards:

N-Q.1. Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

WGYP Standards:

- Mathematical Foundations
- Number Relationships
- Statistics and Probability
- Problem Solving Applications

Objectives/Purpose: Students will better understand the numerical/financial implications of different factors on their car insurance premiums.

Other Resources/Materials:

- Calculators

Activity:

[Student Worksheet](#)

Have students read the WGYP article: “Driver Alert: Car Insurance Will Cost You” Review the following concepts again: A **premium** is the amount to be paid for an insurance policy.

(All information from [State Farm Website](#))

These are three of the most common types of insurances.

Liability – Auto liability insurance coverage pays for the damage if you are legally responsible for accidentally injuring someone, or for damaging another vehicle or other property in an auto accident. Auto liability coverage falls into two categories: (1) **Bodily Injury Liability – which covers medical expenses, pain and suffering, lost wages, and other special damages** (2) **Property Damage Liability – which covers damaged property, and may include loss of use.**

Liability car insurance also pays legal defense and court costs. State laws usually dictate the minimum amounts of auto liability insurance required, but higher amounts are available.

Collision – This auto insurance coverage helps pay for damage to a covered vehicle caused by:

- Collision with another vehicle
- Collision with an object
- A vehicle rollover

A deductible is required.

Comprehensive – This auto insurance coverage helps pay for loss of or damage to an insured vehicle, *not* caused by a collision or vehicle rollover.

Examples of this type of damage or loss include:

- Fire
- Wind
- Hail
- Flood
- Vandalism
- Theft
- Hitting an animal

A **deductible** may apply.

Review the meanings and applications of these types of insurance. Make sure that students understand what each is for. Talk about some different scenarios and which categories different types of accidents would fall into (ex: a tree falling on your parked car – comprehensive, you hitting another car – liability and collision, you hitting a telephone pole but not causing any damages – collision).

Class Discussion: (10 mins)

1. Based on your finding from the lesson on Car Insurance Costs and Correlations and the article, make a list of some of the factors that contribute to car insurance premiums.
2. How much do you think being a teen driver adds on in your state?
3. Every time you have an accident, by how much do you think your premium increases?
4. Make a list of factors that affect these three different types of insurances. (**Liability** – **age, driving record; Collision** – **driving record, type/value of car, Comprehensive** – **area in which you live, etc**)

Discuss the meaning of a **deductible** – (in an insurance policy) a specified amount of money that the insured must pay before an insurance company will pay a claim. Generally, this means that if you get into an accident and your car needs to be repaired, you will first need to meet your deductible before your insurance company will pay for the damages. Deductibles can range quite a bit, but common car insurance deductibles are around \$500, \$1000, or \$1500. This means that if you got into a minor accident where the total damage was only \$400, your insurance might not even cover you at all. Generally, an insurance package for the same driver and the same car with a low deductible is more expensive than a package with a higher deductible. If you are willing to take the risks associated with having a higher deductible, insurance premiums are lower.

Activity: (25 mins)

Have students work in small groups. Tell students that not every person has to do every calculation from numbers 4 – 8. They can “divide-and-conquer.” Students should spend the majority of the time discussing questions 9 – 13. While students are working on the computations for 4 – 8, go around to check to make sure each group is working from the correct answers. You may ask a few students to put their number answers on the board (or you can do it as well.)

Insurance Company X calculates their rates in the following way:

- Their liability, collision, and comprehensive insurances are based on the state averages (in the table below) with a \$1,000 deductible and a car worth \$10,000
- For every \$1 change in the value of a car, the base insurance rate changes by \$0.025 (this means that a car worth \$20,000 is worth \$10,000 more than the base rate – so $\$10,000 \times 0.025 = \250 – \$250 more than the base rate.)
- If a driver opts for a \$500 deductible, add \$30 on to each type of insurance carried
- If a driver opts for a \$1500 deductible, subtract \$35 on to each type of insurance carried
- Insurance for drivers below the age of 21 is twice the state average
- For each accident that a driver has, liability and collision increase by 20%

State	Liability	Collision	Comprehensive	Average expenditure
Alabama	\$354	\$310	\$134	\$667
Alaska	558	375	149	904
Arizona	486	296	207	858
Arkansas	365	283	152	653
California (2)	450	363	103	776
Colorado	427	263	155	729
Connecticut	592	332	121	950
Delaware	698	287	106	1,007
D.C.	583	430	250	1,126
Florida	736	281	114	1,055
Georgia	413	357	164	765
Hawaii	506	312	113	816
Idaho	330	228	116	562
Illinois	401	287	111	720
Indiana	348	243	109	612
Iowa	272	192	153	519
Kansas	299	230	190	576
Kentucky	453	256	122	699
Louisiana	651	410	214	1,105
Maine	336	255	97	600
Maryland	555	316	140	922
Massachusetts	564	293	114	903
Michigan	494	387	152	907
Minnesota	411	207	162	698
Mississippi	366	269	154	654
Missouri	368	251	148	657
Montana	404	241	184	667
Nebraska	308	201	168	547
Nevada	631	335	134	970
New Hampshire	398	277	100	727
New Jersey	721	342	134	1,081
New Mexico	442	294	171	728
New York	687	331	154	1,044
North Carolina	352	240	114	595
North Dakota	242	186	216	503
Ohio	355	239	100	617
Oklahoma	381	275	160	663
Oregon	485	230	95	727
Pennsylvania	490	299	120	817
Rhode Island	646	372	121	986
South Carolina	466	252	147	751
South Dakota	275	186	191	520
Tennessee	356	283	121	641
Texas	471	359	178	854
Utah	430	268	111	709
Vermont	340	280	115	653
Virginia	384	252	114	663
Washington	551	258	116	840
West Virginia	501	289	167	808
Wisconsin	322	202	117	581
Wyoming	322	271	202	632
United States	\$471	\$298	\$134	\$789

Thinking about insurance...

- What types of insurance would you want to carry for a car worth: (explain why)
 - \$500 (**Liability Only – you would exceed the value of the car in paying collision and comprehensive in about 1 year, you could easily just save the money yourself.**)
 - \$2,000 (**Might depend on the deductible, and if you lived in a disaster prone area or were a notoriously really bad driver**)
 - \$15,000 (**Probably all three – but might also depend on your accident record or you living location, i.e. if you live in a place where cars are vandalized or stolen frequently**)
 - \$35,000 (**All three definitely – need to protect car!**)
- If you are more prone to getting into accidents, would that change your answers for #1? (**Yes, you would definitely want to get collision.**)

3. How would you go about choosing which deductible to select? ***(The value of your car, how much you could afford to pay in car insurance payments – remember lower deductible plans have higher premiums and vice versa.)***

Based on the following scenarios, calculate the annual insurance premium with Insurance Company X.

****Make sure that when calculating the annual premium for liability, collision and comprehensive, students add all three columns and do not use the “average expenditure” column. This is not a total!***

*****Students may try to calculate the premiums in different orders. It may be helpful to do #5 with the class to see how everything should be calculated and in which order. Point out that for teens, calculate the premium and then multiple by 2 at the very end.***

4. Age: Adult

State: Utah

Types of insurance wanted: Liability, collision, and comprehensive

Value of car: \$12,000

Deductible desired: \$1,000

Number of accidents: 0

$$(430 + 268 + 111) + (2,000 \times 0.025) = 809 + 50 = \$859$$

5. Age: Teen

State: New York

Types of insurance wanted: Liability and comprehensive

Value of car: \$500

Deductible desired: \$1,500

Number of accidents: 1

$$2 \times [(687 + 134) - (9,500 \times 0.025) - (35 + 35) + (687 \times .20)] = 2 \times [821 - 237.5 - 70 + 137.4] = 2 \times \$650.90 = \$1,301.08$$

6. Age: Adult

State: Pennsylvania

Types of insurance wanted: Liability and collision

Value of car: \$35,000

Deductible desired: \$500

Number of accidents: 3

$$(490 + 299) + (25,000 \times 0.025) + (30 + 30) + (789 \times 0.6) = 789 + 625 + 60 + 473.4 = \$1,947.70$$

7. Age: Teen

State: California

Types of insurance wanted: Liability, collision and comprehensive

Value of car: \$10,000

Deductible desired: \$1000

Number of accidents: 1

$$2 \times [(450 + 363 + 103) \times 1.2] = \$2,198.40$$

8. Age: Teen

State: Pennsylvania

Types of insurance wanted: Liability only

Value of car: \$6,000

Deductible desired: \$1,500

Number of accidents: 0

$$2 \times [490 - (4,000 \times 0.025) - (35)] = 2 \times (490 - 100 - 35) = 2 \times 355 = \$710$$

9. Which of the car insurance scenarios has an element that does not make sense? (Hint: look at the types of insurances selected, the value of the cars, and the deductible amounts.) **(#5 – the driver has comprehensive insurance but the value of the car is less than the deductible.)**
10. Which scenario (#4 – 8) had the most expensive annual premium? What were the factors that contributed to this? **(#7 – was a teen driver with all of the insurance possible and 1 accident. In second place was #6 – which was high despite being for an adult because the value of the car was so high AND because this driver had lots of accidents)**
11. Which scenario (#4 – 8) had the least expensive annual premium? What were the factors that contributed to this? **(#8 – even though was teen driver, had inexpensive car, no accidents, and opted for higher deductible)**
12. If all of the drivers in the above scenarios ran their cars into trees and were damaged beyond repair, would the cars be replaced by the insurance company? And how much would the drivers need to pay? (Make sure to take into consideration the types of insurance carried by each of the drivers and their respective deductibles.)

(This is an issue of having collision insurance! If the driver has collision insurance then he/she is covered minus the deductible).

4 – Yes, insurance company will replace but driver pays \$1,000 deductible

5 – No collision insurance. Driver will have to pay the full \$500 to replace the car

6 – Yes, insurance company will replace but driver pays \$500 deductible

7 – Yes, insurance company will replace but driver pays \$1,000 deductible

8 – No collision insurance. Driver will have to pay the full \$1,500 to replace the car

13. If all of the cars in the above scenarios were damaged beyond repair by a natural disaster, would the cars be replaced by the insurance company? And how much would the drivers need to pay? (Make sure to take into consideration the types of insurance carried by each of the drivers and their respective deductibles.)

(This is an issue of having comprehensive insurance! If the driver has comprehensive insurance then he/she is covered minus the deductible).

4 – Yes, insurance company will replace but driver pays \$1,000 deductible

5 – The driver has comprehensive insurance but since the deductible is \$1,500 and the car is only worth \$500, the insurance company will not pay anything to replace the car

6 – No comprehensive insurance. Driver will have to pay the full \$35,000 to replace the car!!

7 – Yes, insurance company will replace but driver pays \$1,000 deductible

8 – No comprehensive insurance. Driver will have to pay the full \$1,500 to replace the car

Tying It All Together: (10 mins)

1. Have student groups report their answers for 9 – 13.
2. Do you think this method of calculating car insurance is fair? Why or why not?
3. What types of things will you think about when you become a driver?

What Worked and What I Would Do Differently: