The Car Math Workout

Printable Toolkit — Seven Cheat Sheets and Seven Planning Sheets

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Math Didn’t Have to Be This Hard: The Workout Series · Book 8

How to Use This Toolkit

This is the printable companion to *The Car Math Workout*. It has two parts:

- **Seven cheat sheets**, one for each chapter. Every rule is the one the chapter teaches, with one worked example taken straight from the book.
- **Seven planning sheets** to fill in with your own numbers: a fill-up log for your real mpg, a road-trip planner, a yearly maintenance schedule, a shop-quote checker, a deductible worksheet, a loan comparison sheet and a cost-of-ownership worksheet.

Print as many copies as you like. **Fill them in at home or parked, never while driving.**

The numbers in the examples are invented for practice, just as they are in the book, and no car maker, dealer, lender, insurer or shop is named. Your owner's manual sets your car's maintenance schedule, and your insurer and lender set your real terms. This toolkit is for learning; it is not financial, insurance, legal or mechanical advice, and it doesn't teach repairs.

The whole set for this book, including seven free calculators:

`mathworkbook.netlify.app/go/book-car`

1. Fuel Basics

Fill-ups, fuel cost per mile, and your car's real mpg.

- **Miles driven** = odometer now − odometer before.
- **Fill-up** = gallons × the full pump price ($3.499, not $3.50), rounded to the cent.
- **Fuel cost per mile** = price ÷ mpg. $3.50 ÷ 35 mpg = 10¢ a mile.
- **Real mpg** = trip-meter miles ÷ gallons to refill. Several tanks: all the miles ÷ all the gallons.
- **Range** = tank × mpg. Refill at a quarter tank: usable range = 0.75 × tank × mpg.
- **Cheap-gas detour:** worth it only if gallons × price gap beats extra miles × fuel per mile.

> **Worked example (Chapter 1, Example 5).** Priya's 12-gallon tank at 35 mpg: full range 12 × 35 = 420 miles. Refilling at a quarter tank she uses 9 gallons: **315 miles between fill-ups**, and each fill-up costs 9 × $3.50 = **$31.50**.

Your turn. Trip miles _____ Gallons _____ Price _____
Real mpg _____ Fuel per mile _____

2. Fuel Economy Both Ways

MPG, L/100 km, and electric.

- **L/100 km** = 235.215 ÷ mpg, and mpg = 235.215 ÷ L/100 km. Lower is better.
- **km** = miles × 1.609344. **Liters** = gallons × 3.785411784 (1.61 and 3.785 for quick work).
- **Gallons per 100 miles** = 100 ÷ mpg: the fair way to compare cars.
- **Electric:** cost per mile = price per kWh ÷ miles per kWh. kWh per 100 miles = 100 ÷ miles per kWh. MPGe = 33.7 × miles per kWh.
- **Charging blend** = home share × home ¢ per mile + public share × public ¢ per mile.

> **Worked example (Chapter 2, Example 6).** Nadia drives 1,200 miles a month at 3.6 miles per kWh, 85% charged at home ($0.15) and 15% at a fast charger ($0.45). Home: 1,020 ÷ 3.6 × $0.15 = $42.50. Fast: 180 ÷ 3.6 × $0.45 = $22.50. Month: **$65.00**, about **5.4¢ a mile**.

Your turn. MPG _____ L/100 km _____
Gallons per 100 mi _____ My ¢ per mile _____

3. Road Trips

Time, fuel stops and a fair split, planned at home.

- **Driving time** = miles ÷ average speed (at legal speeds). Hours to minutes: × 60. Add every break.
- **Time zones:** one zone west, clocks are an hour behind.
- **Fuel stops** starting full: miles ÷ usable range, round up, minus 1. Stop where there's a station, before the limit.
- **Trip gas** = miles ÷ mpg × price.
- **Fair split:** count the car's wear as well as gas, tolls and parking. Equal shares = total ÷ people.

> **Worked example (Chapter 3, Example 3).** The Reyes family drives 432 miles at 60 mph: 7.2 h = 7 h 12 min. With 90 minutes of breaks: 8 h 42 min. Leaving at 7:30 am, they arrive at 4:12 pm home time, **3:12 pm** park time, one zone west.

Your turn. Miles _____ Average mph _____ Breaks (min) _____
Leave at _____ Arrive at _____

4. Maintenance Math

Schedules, shop quotes and tires.

- **Whichever comes first:** jobs a year = the larger of (miles a year ÷ mile interval) and (12 ÷ month interval).
- **Budget** = add up price × jobs a year for every job; ÷ 12 for a month.
- **Shop quote** = parts + labor hours × rate (+ shop fees and tax, as the estimate states). Get it in writing.
- **Tires:** miles per 1/32 = miles ÷ 32nds worn; miles left = 32nds to go × that.
- **Tire pressure:** about 0.2% of mpg lost per 1 psi low. Use the door placard, not the sidewall maximum.

> **Worked example (Chapter 4, Example 4).** Shop A: parts $168.40 + 1.8 h × $115 = $207.00 + supplies 5% = $10.35 + tax 7% on parts = $11.79: **$397.54**. Shop B: $142.00 + 2.0 h × $125 = $250.00 + tax $9.94: **$401.94**.

Your turn. Parts _____ Hours _____ Rate _____
Fees and tax _____ Total _____

5. Insurance Math

Premiums, deductibles and claims.

- **Periods:** six months ÷ 6 = a month; × 2 = a year.
- **Stacked discounts multiply:** 12% then 5% off = × 0.88 × 0.95, not 17% off.
- **On a claim:** you pay up to the deductible; the insurer pays the rest.
- **Deductible break-even** = extra deductible ÷ yearly premium saved = claim-free years.
- **Collision** never pays more than the car's value minus the deductible.

> **Worked example (Chapter 5, Example 4).** $1,320 a year at a $500 deductible, or $1,152 at $1,000. Saving: $168 a year. Break-even: $500 ÷ $168 = **2.98 years**. Per month: **$96**. Keep $1,000 in an emergency fund first.

Your turn. Lower deductible _____ Its premium _____ Higher deductible _____
Its premium _____ Break-even years _____

6. Buying the Car

Cash, loan or lease.

- **Out the door** = price + sales tax + fees. **Financed** = out the door − down payment.
- **First month's interest** = balance × APR ÷ 12.
- **Payment** = P × r ÷ (1 − (1 + r)^−n), with r = APR ÷ 12 and n = months.
- **Total interest** = payment × months − amount financed. Longer terms: lower payment, more interest.
- **Lease (in this book):** (cap cost − residual) ÷ months + (cap cost + residual) × money factor. APR ≈ money factor × 2,400.

> **Worked example (Chapter 6, Example 4).** $12,000 at 6.9% for 48 months: r = 0.00575; 1.00575^48 = 1.316807; 1 ÷ that = 0.759413; 1 − 0.759413 = 0.240587; $69 ÷ 0.240587 = **$286.80 a month**. Total interest: 48 × $286.80 − $12,000 = **$1,766.40**.

Your turn. Amount financed _____ APR _____ Months _____
Payment _____ Total interest _____

7. The True Cost of Owning

One honest number: a year, a month, a mile.

- **Depreciation per year** = (price paid − expected resale) ÷ years kept.
- **Yearly cost** = fuel + insurance + maintenance + tires + registration + loan interest + depreciation.
- Count only the loan's **interest**: the rest of each payment buys the car.
- **Per month** = yearly ÷ 12. **Per mile** = yearly ÷ miles a year.
- **Fixed vs variable:** cost per mile = fixed ÷ miles + variable ¢ per mile.
- The IRS mileage rate is a tax figure, not your cost.

> **Worked example (Chapter 7, Example 4).** Priya: fuel $1,260 + maintenance $600 + tires $201.60 + insurance $1,152 + interest $743.76 + registration $180 + depreciation $1,320 = **$5,457.36** a year, **$454.78** a month, **43.3¢** a mile.

Your turn. Yearly total _____ Miles a year _____
Per month _____ Per mile _____

Planning Sheet 1: Fill-Up Log

Fill the tank, zero the trip meter, and at the next full fill-up divide trip miles by gallons.

Date	Trip miles	Gallons	Price / gal	Total paid	Real mpg	¢ per mile

For several tanks, add all the miles and all the gallons, then divide once.

Planning Sheet 2: Road Trip Planner

Plan it at the kitchen table, so on the road there's nothing to work out.

Leg (from → to)	Miles	Hours	Breaks (min)	Fuel stop at mile	Gas	Tolls

Usable range = tank × mpg × 0.75 = _____ miles

Trip gas = miles ÷ mpg × price = $_____

Wear = miles × wear per mile = $_____

Each person's share = $_____

Planning Sheet 3: Maintenance Schedule

Copy the intervals from your owner's manual and the prices from your shop.

Job	Every (miles)	or every (months)	Jobs a year	Price	A year

Miles a year: _____

Yearly total: $_____ Monthly budget (÷ 12): $_____

Planning Sheet 4: Shop-Quote Checker

Ask for a written estimate with the parts, the labor hours and the rate. Check every line.

Line	Quote A	Quote B
Parts		
Labor hours		
Hourly rate		
Labor (hours × rate)		
Shop supplies / fees		
Tax (on parts, if stated)		
Total		
Flat rate or actual time?		
Warranty on parts and work		

A flat-rate price is fixed; an actual-time price can grow if the job runs long. Ask for the replaced parts.

Planning Sheet 5: Deductible Worksheet

	Lower deductible	Higher deductible
Deductible		
Yearly premium		
Per month (÷ 12)		

Yearly saving (lower premium – higher premium): $_____

Extra on a claim (higher deductible – lower deductible): $_____

Break-even (extra ÷ saving): _____ claim-free years

My emergency fund: $_____

Does it cover the higher deductible? _____

Planning Sheet 6: Loan Comparison

Same amount financed, different terms or lenders. Compare the APR and the total, not just the payment.

Offer	Amount financed	APR	Months	Payment	Total paid	Total interest

Payment = P × r ÷ (1 − (1 + r)^−n), with r = APR ÷ 12.

Total interest = payment × months − amount financed.

Planning Sheet 7: Cost of Ownership

Yearly cost	Dollars a year
Fuel (miles ÷ mpg × price)	
Maintenance (Sheet 3)	
Tires (price of a set ÷ miles they last × miles a year)	
Insurance	
Loan interest this year (interest only)	
Registration, parking, other	
Depreciation ((price – resale) ÷ years)	
Yearly total	
Per month (÷ 12)	
Per mile (÷ miles a year)	

One-time costs at purchase (sales tax, fees) ÷ years kept: $_____ a year, shown separately.

Fill it in again once a year, or before a big decision: a new car, a big repair, a new policy.