GREEN SHOE GARAGE

Bench to Batch

A field guide to designing, making, and selling small runs of consumer products

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Start here

A buyer just asked for fifty

Could you supply fifty clocks at $45 each? I'd need them in the shop six weeks from Friday.

Nell has sold the tide clock in her shop window. Across town, Mara has its twin on her desk. The blue face lies straight if she backs the bottom screw off a quarter turn. She knows just how far to turn it. Whoever opens box number fifty won't.

Mara has sold twelve clocks directly at $85. Nell's email offers something new. One buyer will take fifty at once. In exchange, Nell gets a wholesale price, a date she can put on the shop calendar and fifty boxes she can hand to strangers. Mara has to decide what that promise will cost.

Her first reply takes four lines.

> *I'd like to check the order. Which finish do you want? When do the clocks need to be on the shelf, and could you pick them up? I'll come back Friday with a quantity, price and date I can stand behind.*

Put one clock, its box and the buyer's email on your bench. Do the same with an order of your own.

Choose your entry point

Have an order in hand? Start with Lesson 1 and work forward. Have a prototype but no buyer yet? Go to Lesson 2. Someone is waiting for a price? Jump to Lesson 5, the fifty-clock comparison.

Mara, Nell and the other shop characters are fictional. Their costs are teaching examples in US dollars. The order uses a 2027 calendar and an illustrative product specification. Published work from Green Shoe Garage and other workshops is identified by name.

Reading guide

What's on your bench?

Choose one question. Each lesson ends with a worksheet that shows a completed shop record, with room for your own. Write on a printed page, copy the prompts into the record you already keep, or use the ebook's printable version.



The five parts follow the life of one batch, from the first promise to the question of a second run.

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Part I

Before you promise

Lesson 1 · Before you promise

Can I fit this order into my week?

There are two empty-looking squares on Mara's calendar each week. Wednesday belongs to commission customers. Friday is the six-hour day she can sell to Nell. If a clock comes back, Mara will answer the email and handle the repair. She'd like the evenings to stay hers.

She sets a second limit while she can still say no. After setting aside money for the shop's existing bills, she can put $600 of her own cash at risk.

Do this now

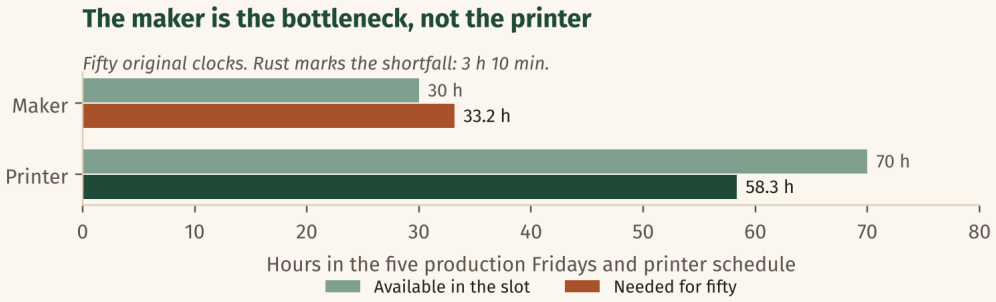
On your own calendar, cross out the hours already spoken for. In your cash forecast, do the same with money promised to someone else.

Which resource runs out first?

Nell needs stock on the shelf by Friday, May 14. She can collect it May 7. The five production Fridays from April 9 through May 7 give Mara 30 hours. Her printer has 70 hours free in the same period.

Fifty original clocks	Time needed	Time available
Maker: 35 min each + 3 h setup + 1 h office work	33 h 10 min	30 h
Printer: 70 min per shell	58 h 20 min	70 h

Take four hours from the maker's thirty, then divide 1,560 available minutes by 35. She could finish 44 original clocks if every one went right. Forty leaves 2 h 40 min of slack. A second printer would do nothing for the pair of hands already booked.



The maker's hours run out before the printer's do. Hands, not machines, set the quantity.

The Friday a part arrives late

Total hours tell Mara whether a job could fit. A particular Friday tells her whether the materials will be there when she needs them.

She books ten shells a week. Those ten occupy the printer for 11 h 40 min. On her second Friday she wants five closed, powered clocks on the bench. She asks for the movements to arrive Thursday so Friday can begin with incoming inspection. Until those parts are there, "run the pilot Friday" is a hope on a calendar.

Try a one-day slip before taking the order

Suppose the movements due Thursday arrive Saturday instead. On Friday she can label cartons and prepare more shells. She cannot learn whether a tightened case makes the hand stick. Waiting until her next available Friday moves the pilot, and its buyer update slips a full week.

Mara asks the supplier to confirm the delivery date before she accepts. If the shipment slips, her first call is to Nell: "I can check the first five next Friday. Is a later full pickup useful, or would you like a smaller early delivery if those five pass?" She can price a split delivery once she knows which option helps.

For your next job, name the part that has to arrive, the person who needs it and the last date the sequence can change. Put the supplier's confirmation next to the calendar block. When something slips, you have a specific call to make.

How many hours can one owner sell?

Worksheet 1 counts calendar hours. Capacity is what remains after everything else has taken its share, so start with the hours you can charge to work and subtract the rest.

Mara's chargeable budget is 1,200 hours a year, from Lesson 4. That averages about 23 hours a week, since 1,200 ÷ 52 is 23.1. The average is not a promise for any single week. Before she counts time as available, she takes out planned leave and holidays, and she keeps the slack in the five-Friday calendar and the return time from Lesson 11 for trouble.

Nell's order uses real capacity. Her fifty clocks took 34 owner hours from design to the return, as Lesson 12 records. Spread over the five production weeks, that is about 7 hours a week, roughly 30 percent of Mara's average chargeable week.

Capacity check	Hours a week	Note
Average chargeable week	23	1,200 ÷ 52, before leave and reserves
Nell's order, production weeks	about 7	34 owner hours over five weeks
Left for everything else	about 16	Commissions, design and selling, which also need owner time

Refuse by hours, not by mood. Write the hours a new order needs, subtract them from the weeks it touches, and compare the result with the hours left. If the order does not fit, the answer is a later date, a smaller lot or a higher price, not overtime. Overtime is a schedule nobody has priced.

Track the week you actually worked. Keep a weekly hours log beside the calendar. One week over plan is noise. Two weeks in a row is a warning, and three weeks is a decision about price, lot size or the calendar. The log also shows whether the 1,200-hour budget is realistic, and the owner-pay rate depends on that figure.

Protect the owner's hours as capacity. Rest, family time and any day job are not spare time. A calendar that counts them as available will fail at the first return. That is why Mara's evenings stay out of the grid.

WORKSHEET 1 · SHOP CALENDAR

Reserve the time you can sell

Make these entries in the calendar or job note you will consult before promising a date. The example uses the original clock.

Which days and commitments am I protecting?

Example · Wednesdays for commissions. Five six-hour Fridays for Nell. Evenings kept for life outside the shop.

What must reach the buyer, and when do I stop building?

Example · Harbor Blue clocks on shelf May 14. Pickup May 7. Movements due before the April 16 pilot.

What fits after setup and office work?

Example · Hands: 1,560 min ÷ 35 = 44 whole clocks at best. Printer: 4,200 min ÷ 70 = 60 shells. Offer 40 original clocks, keeping recovery time.

How much can I spend before payment, and what requires a call?

Example · Limit $600 of shop cash. Call Nell if movement delivery threatens the pilot or if the quantity changes.

Lesson 2 · Before you promise

Will anyone buy it at this price?

One customer took an $85 clock home. Nell is considering a shelf price of $100. Asking her whether she likes the clock will tell Mara very little. Nell has already given it a spot in the window. For a weekend, Nell demonstrates the sample at $100. Eighteen visitors see it. Four leave refundable $10 reservations with the store. Write down all four facts. A reservation after a demonstration is a good reason to prepare an offer. It tells Nell very little about how many sealed boxes will sell while she's across the room wrapping another gift.

Listen to the question behind the purchase

"Will this tell me when I can walk out to the sandbar?" asks one visitor. A buyer can like an object and still expect it to do the wrong job. Mara changes the shelf card to explain how the ornamental dial moves. She asks a new visitor to tell her, in their own words, where they would get a time for a crossing.

Nell is making a second decision. The four deposits total $40, held for her customers. They do little to cover a $2,750 inventory purchase. She chooses to risk one seasonal order because she can demonstrate the clock, collect the cartons on her buying trip and check the count each month. If boxes only sell after a demonstration, she'll keep a working sample on the counter. A quiet shelf would be a reason to reduce the reorder.

If nobody has asked for one yet

Eli has a Raspberry Pi photo frame and no retailer. His first customer turns out to be easier to describe than "anyone with family photos." Someone has to choose a keepsake for a reunion, collect the pictures and get one gift into each household's hands. Who did that job for the last reunion?

Eli asks a past organizer how they handled it. They made printed albums. Collecting the final photographs took longer than arranging the printing. That detail changes the offer he tries.

Eli's offer

I have an offline frame you can take home for a weekend. If a dozen families wanted one at $160 each, would a single approved album on all twelve solve the collection problem? Who would need to see one before you could decide?

That is a specific quantity, price and person to follow up with. If the organizer says they have $50 per family, Eli leaves the sample in his bag and tests a different occasion. If they want the frame but worry about adding pictures, he lets one person try the import on a spare. If they love it and someone else signs the checks, he asks for an introduction.

Try that conversation with one plausible buyer. Write down the words that send you back to the design, the price sheet or a different customer. The question you ask next depends on which answer you heard.

Climb the evidence ladder

Not all interest is equal. Each rung costs the buyer more than the one below it, so each proves more. Mara and Nell rank every signal on the same ladder:

Rung	What it shows	What it does not show
Attention	The design stops a passer-by.	That anyone will pay, or what they expect it to do.
Question	The buyer has a use in mind and says what it is.	That the use is worth the price.
Reservation	Someone has spent a little money and time on the next step.	That the buyer will return once the product is sealed in a box.
Order with a date	A quantity, a price and a delivery date have been agreed.	That the next product will sell on the same terms.

Eighteen visitors and four $10 holds show the first three rungs for the demonstration clock. They do not show demand for fifty. Nell's order does, because it names a quantity, a price and a pickup date. Write down the rung each piece of evidence reached, and do not record a higher rung until the buyer has taken that step. Before taking any money ahead of a build, check the rules that apply to deposits with your payment provider and, where terms are involved, with your adviser.

WORKSHEET 2 · BUYER NOTES

Record what one buyer actually did

Keep this in the buyer's email thread or beside the listing. Record the price shown, even when nobody buys.

Who saw which offer, and where?

Example · Nell demonstrated a running blue clock in the shop window at a $100 shelf price. Eighteen visitors saw it.

What did a buyer expect the product to do?

Example · One asked about crossing the sandbar. Change the shelf card, then ask a new visitor where they would get a crossing time.

What commitment changed hands?

Example · Four refundable $10 holds. Nell keeps those customer funds. Mara has no order payment yet.

What decision can I take now, and what would change it?

Example · Prepare a pickup quote. Track unaided shelf sales separately. Reduce the next lot if sales depend on a demonstration.

Lesson 3 · Before you promise

What exactly am I promising?

Mara empties the sample carton on the kitchen table. The clock and its cable are there. The adapter that powered every demonstration is under her bench. A gift recipient will discover the omission far from the person who built the clock.

Mara could add an adapter and reprice every box. Instead she specifies the buyer's adapter on the outside, where Nell can mention it before the sale. The fictional release in this book uses a 5 V USB-A supply rated for at least 1 A, plus a supplied USB-A to USB-C cable. For a product of your own, take the connector, voltage and required rating from the verified finished design.

One release, three pieces of paper

Sales listing

"Blue indoor desk clock. Displays an approximate tide phase after you set it. Includes clock, cable and setup card. Bring a 5 V USB-A adapter rated 1 A or more."

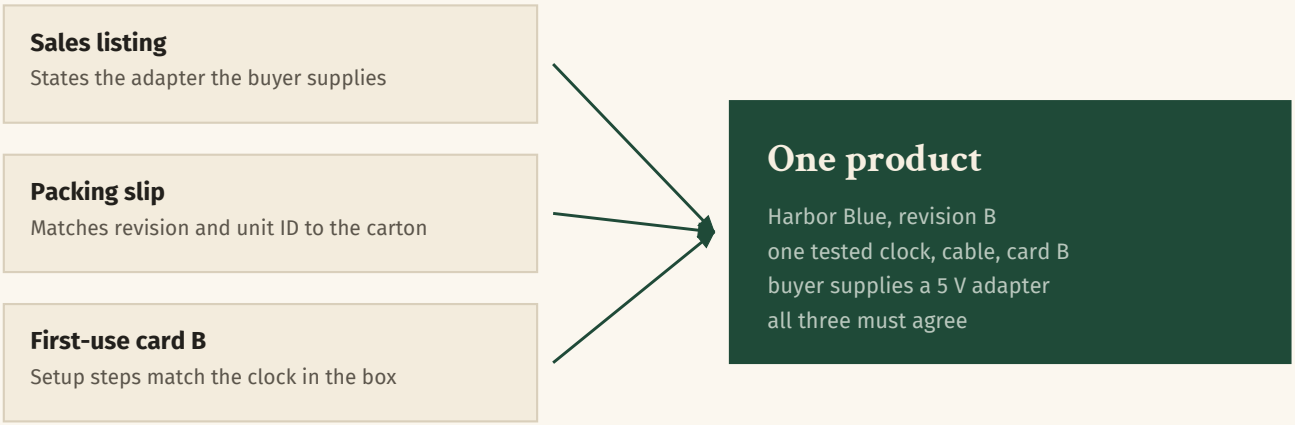
Packing slip

"HARBOR-BLUE, revision B. One tested clock, one USB-A to USB-C cable, one setup card B. Match the unit ID to the carton."

First-use card B

"Plug in the cable and look for the setup light. Find the next high tide for your local station. At that time, hold SET until the hand reaches HIGH, then release. Repeat after power loss. Use station predictions for water activities."

The hand follows a fixed cycle. Local tides vary, so the clock cannot tell anyone when a sandbar is safe to cross. NOAA's station predictions and its description of tidal patterns are on the reference shelf.



One product, three documents. Each must say the same thing, or the buyer trusts whichever they read last.

Why this matters

Three documents describe one product. If the listing says one thing, the card another and the box a third, the buyer will trust whichever they read last. Make the three match before anything ships.

WORKSHEET 3 · RELEASE BRIEF

Check what the box promises

Lay your listing, a sealed sample and its instructions side by side. Send discrepancies to the person who decides whether this version goes on sale.

What will this customer be able to do?

Example · Set an indoor ornament to show approximate phase. Use official station information to plan an outing.

What is packed, and what must the buyer bring?

Example · Clock B, USB-A to USB-C cable and card B. Buyer supplies a 5 V USB-A adapter rated at least 1 A.

Which promise can someone test without me?

Example · After power is restored, a new user sees the setup light and uses card B to return the hand to HIGH at a simulated local high tide.

What would hold this version, and who decides?

Example · Mara holds packing if the card omits the adapter rating. Compare the printed card with the approved box copy, replace wrong cards and recheck the queue before release.

A custom town crest opens a separate question. Ask who can license the artwork, and keep the written permission with its revision. Offer the standard face while you wait. For a change in radio hardware, power arrangement or intended use, obtain a review of the finished configuration for the intended market before quoting that version.

Part II

When someone needs a quote

Lesson 4 · Costing

What does one finished unit cost?

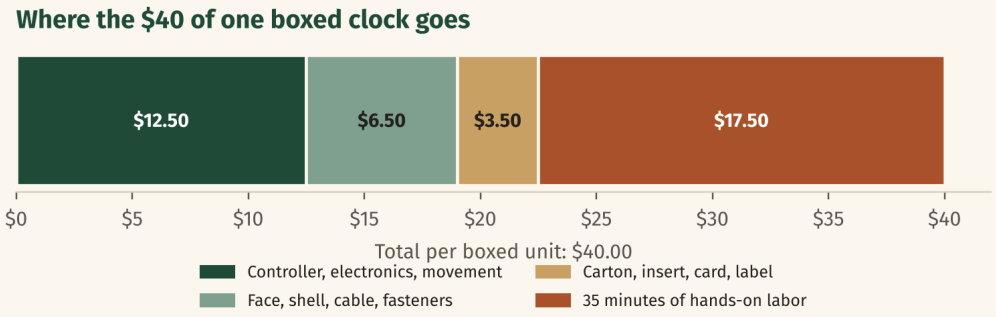
Mara used to stop her timer when the last screw went in. At that point the clock still needed its test, cable, card and box. The buyer pays for a carton they can put on the shelf. That gives the stopwatch a better stopping point.

She takes an original clock apart on a towel. What left the shop in that box? What did it cost to put those items on the parts shelf? A supplier invoices $6 delivered for a bag of 100 screws. Four screws belong to one clock, so its materials line gets 24 cents. The day she buys the bag, her bank account gives up the full $6.

One boxed original clock	Cost
Controller, electronics and movement	$12.50
Face, shell, cable, fasteners and consumables	$6.50
Carton, insert, card and label	$3.50
Parts and packing subtotal	$22.50
35 hands-on minutes at $30 per hour	$17.50
Total per boxed unit	**$40.00**

She folds the card, packs the unit and stops at 35 minutes. Eleven were spent preparing and assembling the housing, six setting the movement. Those two operations give her a place to look for savings. The printer occupied 70 minutes, much of it while her hands were free for other work.

For sheet stock, cost the faces you can use. Seventeen good faces from a $24 sheet cost $1.41 each, to the nearest cent. If that yield already covers ordinary cutting waste, charge only additional damaged pieces as exceptions later.



The parts, packing and 35 minutes of labor that make up one boxed clock.

Where the $30 and the $100 come from

Mara starts with an annual owner-pay target of $36,000. Looking back at the hours she can reasonably charge to jobs, she allows 1,200 hours a year. Dividing one by the other gives her **$30 for each hour she costs to a job**. In this example those hours include design, selling, setup, building and recorded repairs. She puts each hour on one line. Paying herself that rate accounts for her time. The amount left over can fund risk, tools or time between orders.

Try the denominator in your own calendar. If you can assign only 900 hours to orders, the same target takes $40 per hour. At 35 minutes, that puts $23.33 of labor into the original clock before you buy a part. A borrowed shop rate can underprice a beautifully made object.

Which job pays for the machine?

In this five-week budget, $120 of shared machine and shop expense belongs to 70 planned productive printer hours. Fifty shells use 58 h 20 min, or five-sixths of that pool. Mara charges this order $100. Filament already appears under materials. She also sets aside three hours, $90, to pull files, stage parts and prepare the run each time.

Another shop could allocate its shared expense by bench hours. Choose a basis your work actually consumes, write it beside the number, and check at month-end whether the jobs together covered the bills. If the printer sits idle all month, nobody has paid its share.

WORKSHEET 4 · COST ESTIMATE

Cost one unit and one batch

Copy these entries into your estimate. The examples price the original fifty before the design change.

Parts and packing per good unit

Example · $22.50, including $3.50 for the box, insert, card and label.

Ordinary labor and machine occupancy

Example · 35 min × $30 ÷ 60 = $17.50 labor. Reserve 70 printer minutes. Total boxed unit $40.

Setup for this run

Example · 3 hours × $30 = $90, once for fifty.

Shared expense and its basis

Example · $100, the clock order's share of the five-week printer-hour pool.

Time spent selling and handling the order

Example · 2 hours × $30 = $60. One hour before the slot and one in production.

Allowance for failures and service

Example · $60 initial estimate. At review, replace it with actual rework, extra parts and recorded support.

Lesson 5 · Pricing

What price pays both shops?

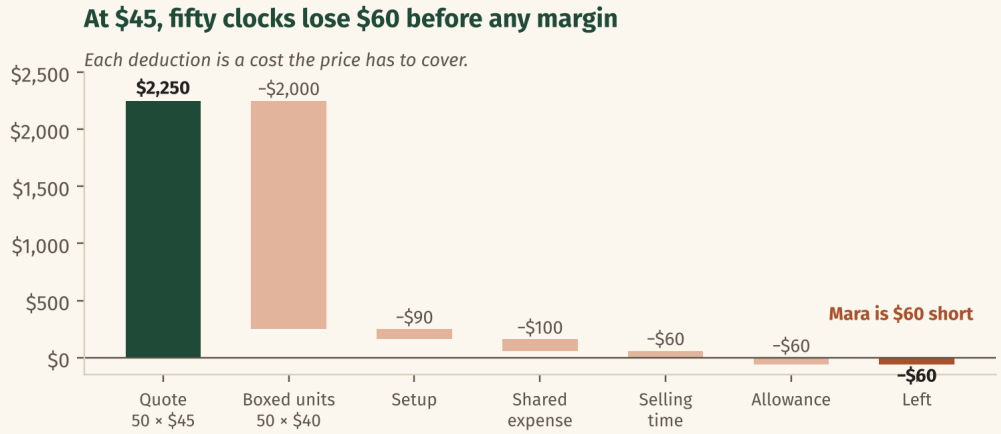
Put $45 on a quote for fifty original clocks and $2,250 comes back. The fifty boxed units cost $2,000. That apparent $250 has four bills against it. Setup takes $90, shared expense $100, selling time $60, and the allowance for failures and support another $60. Mara would finish the order **$60 short**.

Nell wants to keep 45 cents of each dollar of shelf sales to pay store expenses and earn a return. At $85 retail, that leaves $46.75 for a clock delivered to her. At $100, it leaves $55. She can collect the cartons on a trip she already makes. If Mara invoices $55 and Nell pays $3 freight per unit, Nell's landed cost becomes $58, and her margin at $100 falls to 42%.

Change one thing at a time

Forecast for fifty	Original at $45	Original at $55	Revised at $55
Ordinary minutes per clock	35	35	25 (estimated)
Maker time in slot, before rework	33 h 10 min	33 h 10 min	24 h 50 min
Left after recurring costs	−$60	$440	$690
First-run design and tooling	$0	$0	$160
Left on this first order	**−$60**	**$440**	**$530**

The middle column explains the whole negotiation. Changing the price pays Mara, but she is still **3 h 10 min late**. To offer fifty at this date, she must change the way she makes them. A reduction to forty original clocks could also work if Nell agrees to a smaller order.



Fifty clocks at $45: the quote covers the boxed units, but not the costs around them.

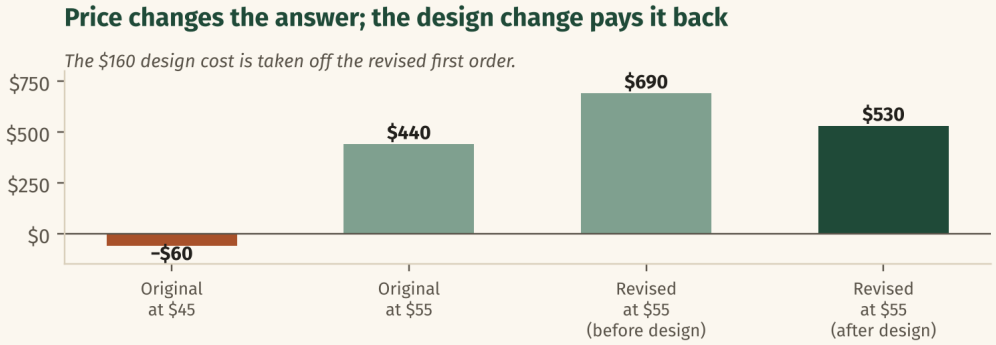
When is a faster build worth buying?

Look at the two pieces Jules will later handle on the assembly bench. The original face can seat backward. Getting it aligned eats minutes even when Mara catches the mistake. She can spend four design hours and $40 in trial stock to change the locating features. At her rate, that is $160, spent before the production slot. The three hours needed to stage the approved parts will still recur on the next run.

If the new fit saves ten minutes, it saves $5 each time, and the 32nd good clock recovers the $160. If it saves only five minutes, fifty clocks recover $125, which still leaves the order $35 short of paying back the change through labor savings alone. Mara keeps both estimates on the sheet and marks which number she must time on the first five units.

What if the buyer will take forty?

Forty original clocks at the same finish cost $1,600 in materials and build time. Setup and admin still cost $150. At $2 of overhead and $1.20 of allowance per clock, add $128. The cost is $1,878. At $45, the smaller job loses $78. At $55, it leaves $322 before tax, and it fits the five Fridays with 2 h 40 min to spare.



What is left on the first order under each option. The design change is repaid only if the new build is faster.

Now Nell can consider two useful offers. Fifty revised blue clocks at $55 depend on approving the revised sample. Forty of the original design at $55 need no redesign. Mara can explain what the extra ten clocks require and what the shop buys by going with the smaller lot.

WORKSHEET 5 · PRICE LIST

Find the overlap in dollars

Use the same revision and quantity on both sides of your calculation. This example is for the original fifty with local pickup.

What does the whole run cost, including my time?

Example · 50 × $40 + $90 setup + $100 shared + $60 selling + $60 allowance = $2,310.

What price gives me the return I want?

Example · Cost $46.20 each + desired $8 each = $54.20. Round the proposed wholesale price to $55.

How much can the buyer pay, including inbound freight?

Example · $100 retail × 55% available after margin = $55 delivered. Pickup on an existing trip adds $0 carrier charge.

What can I offer at that price and on that date?

Example · Original fifty miss pickup by 3 h 10 min. Offer forty original or fifty revised, with sample approval and a pilot check.

If your sales channel keeps a percentage, calculate it on the money the customer pays. To keep $54.20 after a 5% fee, divide by 0.95 and round up: $57.06.

Lesson 6 · Quoting

What do I put in the offer?

Before sending the email, Mara looks at the lowest point in her cash forecast. The $40 for trial stock has already left. The next purchase is $1,125 for standard parts. If Nell pays after delivery, Mara must advance $1,165, well past her $600 limit. A higher price due next month can't buy a motor today.

With a cleared half-deposit, the order's cash position runs from −$40 to $1,335 and then to $210 when she buys the parts. The deposit pays for a promise she still owes. Answering an email hasn't earned her the $1,375 yet.



The deposit is what keeps the cash position above the $600 limit while parts are bought.

The offer Nell accepts

> I can have fifty Harbor Blue desk clocks ready for your pickup Friday, May 7, at $55 each. Total $2,750. Each box contains the approved blue clock, power cable and setup card. The adapter requirement appears on the box.
>
> Please approve sample B and send the $1,375 deposit in time to clear by Friday, April 2. That reserves the slot. I'll report on the first five April 16. The $1,375 balance is due before pickup. If you change the face, finish or quantity, I'll send the new price and date before making the change.
>
> If a fault threatens pickup, I'll call the day I find it. At collection we'll count the cartons together. Please keep any damaged packaging and contact me with the carton and unit IDs so I can arrange the next step.

Nell accepts the standard blue face, the deposit and pickup. Mara files her reply with the sample revision. The buyer has approved what she will receive. The next question is whether the production method can deliver it in time.

Three replies worth having ready

If the buyer asks to pay on delivery. The order still has room on the calendar. The cash doesn't. Mara can explain the condition without opening her bank statement.

> I can reserve the five Fridays once the deposit clears. If payment can only happen at pickup, I can quote a smaller first lot that I can fund myself. Which quantity would be useful on your shelf?

Before naming that quantity, subtract pre-order spending from the cash limit and check minimum pack sizes. Even if parts cost exactly $22.50 per clock, the $560 left after trial stock buys at most 24 complete sets. Other cash expenses could bring the safe quantity lower.

If the approval comes late. A slot held through April 2 is perishable.

> The original approval date has passed. Let me check what I can finish by May 7. I'll confirm a smaller pickup or the next complete-batch date before taking payment.

A late reply alone doesn't move the courier or free a Wednesday.

If Nell insists on $45 for all fifty.

> Thanks for asking me. At $45 I can't supply fifty boxed clocks, test them and support them on those terms. I'll pass on this run. If $55 with pickup becomes workable, I'd be glad to check the next slot.

A refusal can be that short. Mara has calculated why. Nell only needs to know what she can count on.

Cash across several orders

One order can be funded. Two overlapping orders can run out of cash while both look profitable on paper. A cash ledger shows the timing, which the profit line hides.

Mara's ledger for the fifty clocks lists cash in the order it moves, using the figures from this lesson and the worked money example:

When	Event	Money in	Money out	Balance
Before April 2	Trial stock		$40	−$40
April 2	Deposit clears	$1,375		$1,335
Week of April 6	Standard parts		$1,125	$210
During the run	Replacement face and service postage		$20	$190
May 7	Balance at pickup	$1,375		$1,565

The balance falls to $190 before pickup and ends at $1,565. That cash must still cover Mara's owner time and the shop's overhead. After those, $445 is left before tax, as the worked example shows. Cash is not profit. The same $1,565 looks generous until the owner's hours are counted against it.

Now suppose Nell reorders twenty clocks while the first order is still in production. The second lot has its own rhythm: a $550 deposit at approval, $450 of parts (20 × $22.50) before the build, $40 of overhead, and a $550 balance at pickup. If the second lot's parts are bought in the same week as the first order's parts, the combined balance drops to −$240 before any deposit arrives. That is inside the $600 Mara allowed herself to put at risk, but it leaves no room for a surprise, such as a late part or a short pickup payment.

Buy against deposits. Order materials after the deposit that pays for them has cleared. If you must buy earlier, write the gap into the forecast as money at risk, and decide whether you can carry it.

Keep an eight-week cash forecast. List every expected receipt and payment by week, and update it when a deposit clears, a part slips or a balance is paid. The forecast is the calendar of money, and it shows the low point before it arrives.

Ask for a deposit on every commission. A $650 commission with $90 of materials, paid half up front, brings $325 before any material is bought. That covers the $90 and leaves $235. Without the deposit, the same commission carries the materials for the whole twelve hours.

WORKSHEET 6 · QUOTE EMAIL

Draft the reply you will send

Write the four parts of one message. Use the calendar you share with the buyer for every date.

Item, revision, quantity and box contents

Example · 50 Harbor Blue B clocks, individually boxed with cable and card B. Customer supplies the specified adapter.

Price, separate charges and total

Example · $55 each. Standard face. No freight charge on pickup. Total $2,750.

Approval, payment and delivery dates

Example · Approve sample B and clear $1,375 by April 2. Remaining $1,375 before pickup May 7. Pilot update April 16.

What changes the promise, and how will they hear?

Example · A changed finish or quantity gets a fresh quote. A threatened pickup gets a same-day call. Count cartons at pickup and record damage by unit ID.

Part III

When parts are on the bench

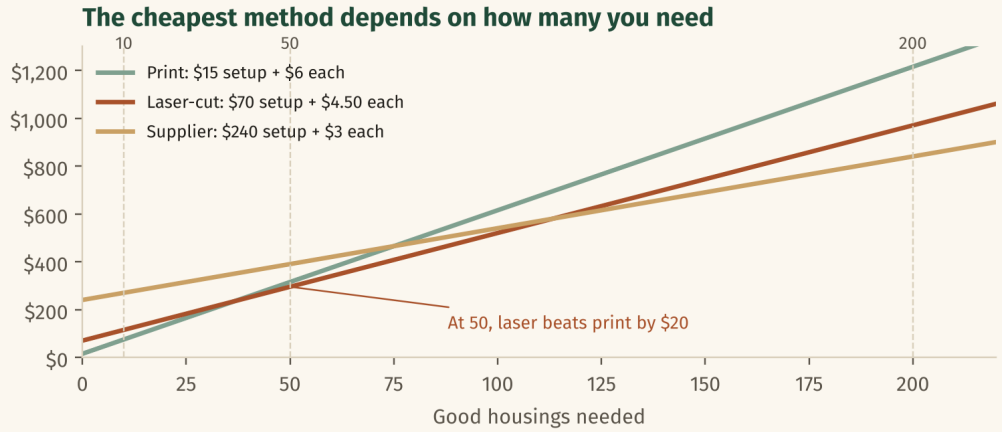
Lesson 7 · Production

Should I make this part or buy it?

Mara's Arduino works. The part that keeps her hands busy is the face. Before asking for a custom circuit board, she puts three methods for making a housing on the same sheet. These are practice quotes for one acceptable finish, kept separate from the clock ledger.

Method and cost basis	10 good parts	50	200
Print: $15 setup + $6 each	$75	$315	$1,215
Laser-cut: $70 setup + $4.50 each	$115	$295	$970
Supplier: $240 setup + $3 each	$270	$390	$840

At fifty, the laser-cut option wins by $20. Spread that over fifty housings and the advantage is 40 cents each, or **48 seconds** of fitting at $30 an hour. A minute with a file would turn the apparent winner into the more expensive part.



Each method's total cost against quantity. The lines cross, so the right choice depends on how many you need.

Mara cuts a strip of test slots and labels them. A tab from one print seats in the middle slot. A second printed tab needs filing in that same slot. She times a minute of fitting, saves both samples with the cut revision, and keeps the printed housing for this quote. At 200, the supplier deserves another look, if she can sell them, fund the minimum and approve a matching sample.

Buy, carry or custom?

A custom board gets the same test. Keep the stock controller while it fits, can be bought and does what you promised. Consider a carrier when a repeatedly hand-wired connector eats assembly time. Consider a custom board when space, supply or measured savings justify designing and qualifying it. At $1,200 in development and $6 saved per unit, the 200th good unit recovers the investment.

The movement that almost fits

Before Mara orders the fifty movements, the supplier offers a substitute under the same catalog description. The mounting holes line up. That is enough to get the sample into a case. It tells her nothing about where the hand will sit once the cover is closed.

During the pre-order bench work, she fits the sample to the revised support, installs the hand, tightens the case and tries a full turn. The substitute puts the hand too close to the face. She marks the sample bag "alternate, hold," keeps it out of the production bin and confirms that fifty of the approved movement can arrive before the pilot. The check uses the trial materials and design time already budgeted.

The note attached to the purchase order

H50 · Use approved movement lot M2 for planned units B-001 through B-050. Alternate sample binds in the closed case. No substitution on this order without a new fit and motion check. Mara confirmed M2 availability before releasing the purchase.

If M2 became unavailable halfway through, her record would identify the last unit built with it, the first unit held and which unpacked cartons contained which movement. Open a new revision or approved substitution record before mixing lots. A substitute that changes hand height can also invalidate the earlier clearance test.

Send a supplier the part identifier and revision, two features that must mate, a finish sample, the quantity and the required arrival date. Ask whether an alternate can appear without notice. A "yes" changes what you inspect at receiving.

Keep the parts shelf honest

Stock is cash that has been spent but not yet sold. Mara's shelf holds the screws, springs, adhesive and movements for the next fifty clocks. Each item earns its place only if it will be used before it expires or changes, if it is needed soon enough to justify the cash, and if it can be trusted when it arrives. Many small shops that run short of money do not lose it on sales. They lose it on parts that sat on the shelf too long.

Count what a bulk buy really costs. Mara's screws cost $6 per bag of 100, delivered. A supplier offers 1,000 for $45, which is $4.50 per hundred. The bulk price saves $1.50 per hundred, but only for screws that get used. Her as-needed cost is $0.06 per screw, so the bulk buy pays only if she uses at least 750 of the 1,000 before they become unusable: 750 × $0.06 = $45.

She uses four screws per clock and builds ten clocks a week, so the shelf loses 40 screws a week. A thousand screws would last 25 weeks. Now suppose a revision changes the screw length in eight weeks. By then she has used about 320 screws. Buying as needed would have cost four bags, $24, for those 320. The bulk buy cost $45 and leaves 680 screws that no longer fit. The bulk buy loses $21. Add the cost of the cash itself, using the borrowing rate you use for other decisions, before you decide.

Set a reorder point from use and delivery. Work out the weekly use, the delivery time the supplier actually achieves, and a safety margin for delays. Mara's screws have a three-week delivery and she wants a one-week margin, so the reorder point is 40 × (3 + 1) = 160 screws. She reorders when the count falls to 160, and orders two

bags, which lasts five weeks at 40 a week. If the delivery takes four weeks instead of three, the margin is used up and the shelf reaches zero before the bags arrive. Record every late delivery, because the margin should cover what the supplier really does, not what the quote says.

Check the shelf by value. Sort parts by the cash each one ties up. The few expensive items, such as movements, get a weekly count and a written reorder point. Cheap bulk items, such as screws, get a monthly count. Review every number after each batch. A part that sold every week may sit untouched for months once the design moves on, and it needs an order rule to match.

Track consumables by open date. Adhesives, solder paste, lubricants, batteries and some coatings degrade. Record the open date, use the older stock first, and store each item the way its data sheet says. Take the shelf life from the data sheet or the manufacturer, not from memory. A simple log keeps the dates where you can see them:

Item	Opened	Shelf life source	Test before use	Discard when
Adhesive, tube A	April 2	Manufacturer data sheet	Bead on a spare housing at the start of each run	The test fails, or the data sheet's shelf life has passed
Adhesive, tube B	Not yet opened	Manufacturer data sheet	Same test, on first opening	Not applicable until opened

Mara writes the open date on each tube, uses tube A before tube B, and tests a bead on a spare housing before each run. If a test fails, she discards the tube and notes the batch on the job record.

Check that parts are genuine. Counterfeit and mislabeled electronic components are a real risk when a price is far below the market, when a source is unfamiliar, or when the packaging looks reworked. Checks that help:

- Buy from the manufacturer or an authorized distributor where you can, and ask for traceability documents with the lot.
- Compare the marking on the part, the date code and the lot code with each other and with the manufacturer's format for that part.
- Look for signs of re-marking: sanded or refinished package tops, mismatched fonts, damaged or oxidized leads, and reels or trays that differ from the manufacturer's usual packaging.
- Check moisture barrier bags and humidity indicator cards where the part uses them, and record what you saw.
- Test a sample from the first delivery against the key values in the datasheet before releasing the rest of the lot.

A price far below the market is a reason to slow down, not a bargain. A failed visual check is not proof on its own, and a passed one does not prove a part is genuine. If a supplier cannot give you a traceable source, treat the parts as unverified and keep them off any product you sell.

Qualify each supplier once, then recheck. Order a small trial lot, record the lead time you actually get, note the packaging, and compare the delivered quality with the datasheet. Requalify when the product, the part or the supplier changes. A supplier that delivers well once has not yet proved it will do so for every lot.

The shelf test is simple. List every item, the cash it ties up, the weeks of use it covers and the date it expires or changes. Anything that covers more than the next batch or two needs a reason, and anything that expires before use leaves the next order.

WORKSHEET 7 · SOURCING DECISION

Record why this method won

File the result with the drawing, sample and supplier quote. The example uses the fifty-housing comparison.

Part and acceptance condition

Example · Print-compatible clock housing. Approved finish. Tabs seat by hand and the closed face clears the movement.

Delivered cost at the quantity I can sell

Example · Print $315. Laser $295 before extra fitting. Outside supplier $390 for fifty. Recompare at 200 if demand becomes credible.

What measurement could reverse the ranking?

Example · Laser saves 40 cents per housing. Extra fitting must average under 48 seconds at $30 per hour to keep the saving.

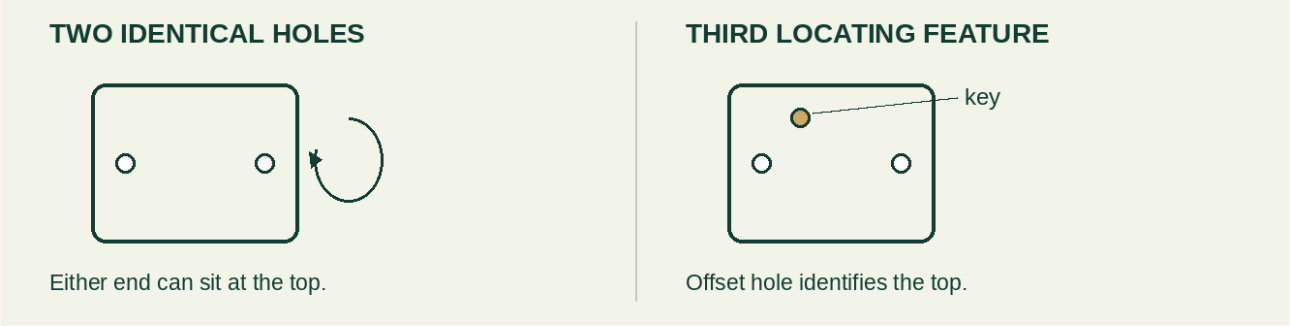
What did the sample show, and what will I buy?

Example · A second tab needed a minute of fitting. Keep printed housings for this order. Keep the labeled coupon for the next material revision.

Lesson 8 · Production

Could someone else build it?

Seven minutes after Mara hands over the parts, Jules turns the face half a turn. The locating pins seat perfectly. The dial is upside down. Mara has been lining it up by eye for so long that she forgot the pins would let somebody do that.



Revision B adds a third, offset locating feature, so the face can seat in only one orientation.

Before the change, the instruction could only tell Jules to pay attention. Revision B adds an offset feature to both pieces. Mara tries to seat it backward with ordinary hand pressure. Then a fresh builder tries the correct orientation. It seats without a file. The revised instruction now says, "Match the offset holes and seat the face flush before attaching the hand." A builder can see when that step is complete.

Two screws still look alike. Mara gives each length a labeled pocket and adds an actual-size outline to the pick list. Two firmware files still say "final." She archives one release, loads clock-1.1 and reads the identifier back from the unit.

Test the instructions with a stranger's hands

In this example Jules lends a hand with the trial. Budget any paid helper, and the time you spend observing, when costing your own revision. A second builder should receive the parts list, drawing, firmware, tools, instructions and test a normal employee or helper would get. If you work alone, rebuild from an empty bench and a clean copy of the files. That will reveal a missing tool or file. A new pair of hands is still the best place to discover instructions that make sense only to their author.

WORKSHEET 8 · BUILD INSTRUCTIONS

Capture the first snag

Save the revised instruction and test result in the release folder. Keep one line per unit in the record that travels with the product.

What did I hand the second builder?

Example · Original clock face and support, matching pins, actual tools and original instructions. The task was to install the dial.

What did the builder do, and what allowed it?

Example · Jules installed the face backward. Both pins seated because the two-hole pattern was symmetric.

What changed in the part and instructions?

Example · Rev B adds an offset key to face and support. Match offset holes and seat face flush before attaching the hand.

What did the fresh builder and the sample prove?

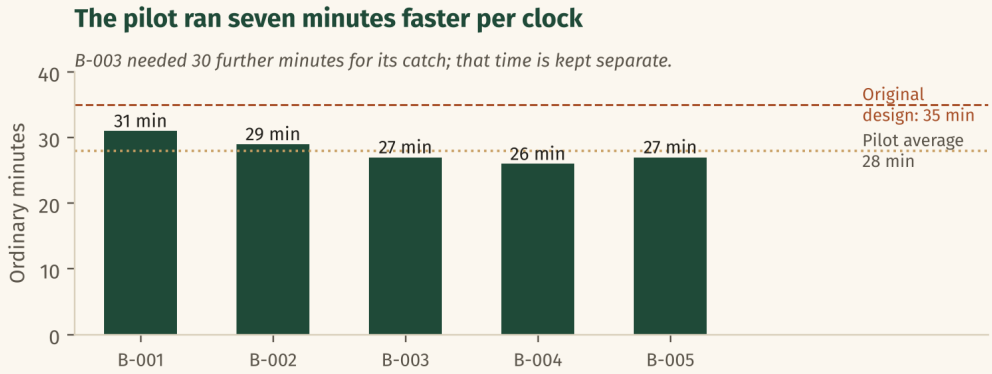
Example · Backward face cannot seat by hand. Correct orientation seats flush without filing. Build record for B-014, face B, movement M2, clock-1.1 read back.

Lesson 9 · Release

Can I release the rest of the batch?

Clock B-003 works until Mara tightens the case. Then the hand catches. She writes "catches after tightening" on the build sheet. Calling it a bad motor would put an innocent part on trial before she knows where the drag comes from.

The first five clocks take 31, 29, 27, 26 and 27 ordinary minutes. That makes 140 minutes, or 28 per clock. B-003 needs another 30 minutes to investigate, correct its seating and retest. Four passed first time. Five pass after correction. The extra half hour goes in the rework column.



Ordinary minutes per clock in the pilot, against the original 35. The rework for B-003 is recorded separately.

Mara adds a seating-depth gauge. She checks the original five closed cases again, then watches the next five go together with the gauge. If the catch recurs, affected work stays on hold. When those five pass and the earlier units are accounted for, she authorizes building the remaining forty. Each finished clock still needs its own shipping checks.

Can she still promise May 7?

Fifty clocks at 28 minutes need 23 h 20 min. Add three hours of setup and one hour of office work inside the slot. Of the original thirty hours, **2 h 40 min** are available for trouble. B-003 has used half an hour, leaving **2 h 10 min**.

> The first five now pass. One caught after tightening, so I changed the seating check. Pickup is still May 7. If the catch shows up again, I'll hold those clocks and call you.

The three extra ordinary minutes across fifty units cost $75. Her first-run forecast falls from $530 to $455. Price, pickup and margin are three different promises, and the evidence here changes the margin.

Decide what passing means before the pilot

A pilot without written pass criteria turns every result into an argument. Mara writes each test and its pass line before the first clock is built:

- After final tightening, the hand clears the closed face through one full turn, in the upright and the flat positions.
- Setup, from the sealed box to the first set time, takes no longer than the time printed on card B when a second builder follows it.
- Rework on any single unit stays within the 30 minutes Mara has set aside for investigation.

Five passes are not a rate. Five clocks that pass show that the process worked for those five. They do not show how often a fault appears. A common rule of thumb says that after n units pass with no failures, the true failure rate could still be as high as about 3 divided by n, at roughly 95 percent confidence. Five clean units leave room for a fault in up to about 60 of every 100. Sixty clean units bring that bound down to about 5 in 100. Mara treats the five-unit pilot as a test of her method, and she keeps the depth-gauge watch on the next five before she trusts the rate.

Decide what a failure stops. A failure does not automatically stop the batch, and it does not automatically ship. Before the test, write the scope: the unit, the lot, the revision or the whole order. Mara's rule is that a catch holds that unit, and every unit built with the same seating step, until the cause is known.

What exactly passed?

A service sweep is a bench mode that moves the hand quickly all the way around. On a closed case it can reveal rubbing. A normal revolution takes hours. A fast sweep cannot tell Mara whether the normal clock keeps its specified cycle.

Check	What Mara observes
Release sample, normal mode	Time a full revolution with an independent clock. Fictional spec 745 min ±3. A 740-min result fails.
Each clock, powered from cold	Setup light appears. SET reaches HIGH. Unit enters normal mode.
Each closed clock	Sweep through one turn. Record the orientation, any contact, and the result after rework.
Before sealing the box	Leave service mode. Match unit ID, finish, cable and card revision to the order.

At this point Mara records her sweep with the clock lying flat. A return will show what that check misses. If you build a product with a hinge, lid or moving hand, test the finished object in the position your customer will give it.

From Green Shoe Garage

In the Mouser project *Empower Emotions in the Physical World*, the first servo motion is checked before coupling the servos to the mechanism. An unexpected direction is much easier to see and correct there. In the clock, a later check with the mechanism fully enclosed answers a different question. Keep both stages when each catches a different fault. See Michael Parks's Raspberry Pi and servo project.

Adafruit's test fixture gives the operator light and sound feedback when a board makes contact with spring pins. Try a known fault as well as a known-good sample before relying on such an indication. Keep final mechanical checks on the assembled product. See Adafruit's testing fixture demonstration.

WORKSHEET 9 · RELEASE RECORD

Record the decision to continue

Use this sheet for the pilot decision. In the build record, keep the result against every unit that ships.

Which product and units are under review?

Example · H50, B-001 to B-005, assembly B, approved movement M2 and firmware clock-1.1.

What did the test require, and what failed?

Example · Sweep the hand with the case closed, flat, after final tightening. B-003 caught. Four of five passed first time.

How much work did it take, including rework?

Example · 140 ordinary minutes, average 28. Add 30 min separate rework. Replace 25 min with 28 in the forecast.

What can proceed, and what is still on hold?

Example · Five corrected or verified. Observe the next five with the depth gauge. Once those pass, continue building. Each unit needs its own recorded checks before shipping.

What will the buyer hear?

Example · Same May 7 pickup. Rework reserve after pilot: 2 h 10 min. Mara calls Nell if the catch recurs or if the remaining time no longer covers the work.

Part IV

When the product leaves the shop

Lesson 10 · Selling

What does the buyer need to see?

Nell's first clock sold while the hand was moving in her window. Fifty closed cartons have a different job. Mara asks Nell to play the customer while she tries three versions of the same product description. Each one has a different reader.

At the shop counter

> It's a little reminder of the coast. Set the hand to HIGH at a local high tide and it goes around on its own. For a walk out to the sandbar, let me show you the local tide predictions. They're what I'd use to plan the trip.

Nell leaves a powered sample beside the stack and turns one box so buyers can read the adapter requirement. When somebody opens the gift, the setup card has to do the rest of Nell's job.

On the product listing

> Harbor Blue indoor tide clock, $100 at Nell's shop. Blue laser-cut face in a 130 × 120 × 55 mm desk case. Set it to a published local high tide for an approximate phase display. Reset after power loss. Includes clock, USB-A to USB-C cable and setup card. Supply a 5 V USB-A adapter rated at least 1 A. Available in store from May 14 while stock lasts.

The measurements and power rating belong to the fictional sample B. For yours, measure the shipping revision and photograph it with the cable attached, beside a familiar object, and next to everything in the box.

On the retailer's order sheet

> HARBOR-BLUE · revision B · first order 50 × $55 = $2,750 · local pickup May 7 · allow six weeks from a confirmed reorder, subject to quantity and slot · reorder by email at mara@harborclock.example.

Someone at Nell's counter can now reorder even when the buyer is out. Six clocks will need their own quote.

Every claim needs a record and a home

A listing makes promises. Each claim in it needs a record that supports it, and the record should sit where the claim lives. If you cannot name the record, remove the claim.

Claim in the listing or card	Record that supports it	Where it must match
Shows an approximate tide phase after setting to a local high tide	Set-and-check test record on the shipping revision	Listing, card B, sales script
Blue laser-cut face, 130 × 120 × 55 mm	Measurements of the shipping revision, not the prototype	Listing, retailer order sheet
Needs a 5 V USB-A adapter rated at least 1 A	Test with the supplied cable and a rated adapter	Box, card, listing, pickup count
Available from May 14 while stock lasts	Stock count and the date in the calendar	Listing, order sheet

The word "approximate" is part of the promise. A display set by hand after a power loss is not a tide table, and the claim should say so. Check every row again when the revision changes. A corrected card that disagrees with an old listing makes the same mistake as a wrong card.

WORKSHEET 10 · RETAILER ORDER SHEET

Give the retailer one usable order line

Put this on a retailer line sheet or in a saved reorder email. The listing and shelf copy above answers the questions a gift buyer is likely to ask.

Product, code and release

Example · Harbor Blue indoor ornamental desk tide clock, HARBOR-BLUE, revision B. One blue finish.

Contents and buyer-supplied item

Example · Clock, USB-A to USB-C cable and card B. Owner supplies 5 V USB-A adapter rated at least 1 A.

Terms for this order

Example · 50 at $55 each, total $2,750. $1,375 deposit, $1,375 before May 7 pickup. Shelf price in this example $100.

How does a store employee reorder?

Example · Send finish, quantity and required date to mara@harborclock.example. Allow six weeks from a confirmed slot. Mara confirms fresh price and pickup for the actual quantity.

Lesson 10 · Delivery

When the cartons change hands

On Friday, May 7, the clock order stops being a row on Mara's bench and becomes stock in Nell's shop. Mara packs five outer cartons of ten retail boxes. She records the inclusive unit range on each. That makes an apparently fussy number useful when someone calls from the other end.

> H50 · pickup May 7 · cartons 1–5 of 5. Carton 1 B-001–010, carton 2 B-011–020, carton 3 B-021–030, carton 4 B-031–040, carton 5 B-041–050. Fifty accepted for handover. Card B throughout. Balance $1,375 received. Mara and Nell counted five outer cartons at collection.

They inspect the outsides together. Nell will verify the inner count when she stocks the shelves. The signed pickup count establishes who received the cartons and how many. Mara's per-unit test records tell her which clock was inside each one.

Suppose carton four arrives crushed

This is a separate exercise. The actual order was collected without a damage claim. For a carrier shipment, agree who books the service and who files a claim. Save the tracking reference with the packing record.

Ask Nell to set aside carton four, keep its packing, photograph the damage and identify affected units before putting them on sale. Mara can trace B-031–040 and offer a remedy for the affected pieces. Record replacements and freight against the order, and confirm with Nell what remains sellable. A signed count of five boxes by itself would tell the two shops very little about this problem.

Write the packing specification

Packing is part of the product. A clock that arrives cracked has failed, however well it was tested on the bench. Write a short packing specification that any packer can follow, and keep it in the release folder:

- The retail box, the insert that holds the clock still, and the outer carton, each with its revision.
- How many retail boxes go in each outer carton, and the unit range printed on the outside.
- What fills the empty space, and where the card and cable sit.
- The label fields: product, revision, unit range, lot number and the packer's initials.

Test the pack, not only the product. Drop and vibration tests on a packed carton show whether the insert and the carton hold the unit. The International Safe Transit Association publishes packaging test procedures to adapt. Choose the one that matches how your product travels. Pack and test one carton per revision, keep the record with the lot, and retest whenever the box, insert or carrier changes. A damage claim is much easier to pursue when you can show what the carton looked like at pickup and what it was tested to survive.

Lesson 11 · Support

What do I do when one comes back?

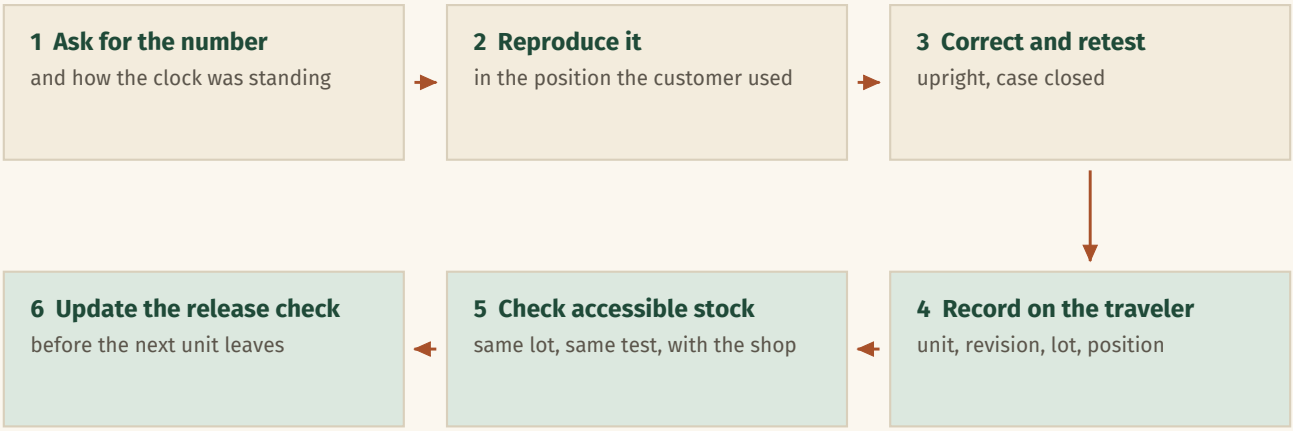
"It moves when I set it, then catches near the top." That is a better starting point than a guess about a motor. Mara sends a short reply.

> Thanks for telling me. Could you send the number on the back and tell me how the clock was standing when it caught? I'll arrange the return. Please leave it assembled so I can try it just as you used it.

B-037 passes the sweep on its back. Mara stands it upright. Near the top, the hand brushes the face. She corrects the seating, closes the case and sweeps it again in its usual position. The earlier B-003 fault showed up after tightening. B-037 had passed the shipping test with the case tight, because the clock was lying flat.

> I found the rub with your clock standing up. I corrected the movement seating and checked the whole turn with the cover on and the clock upright. I'm sending it back to you and adding that check to the clocks still in the shop.

Mara ties the report to revision B and lot M2, checks her retained sample, and arranges an upright check of accessible stock with Nell. Her change record reads: "Mara to add upright closed-case sweep before the next unit leaves. Record position and result on the traveler." The traveler is the sheet that follows the unit. The repair takes 20 minutes and $12 of postage and material. Total cost: **$22**.



The route a returned unit takes, from the first message to the change that protects the next shipment.

Safety reports take a different route

A report of smoke, overheating or injury is not a support ticket. Preserve the unit and the report, isolate affected stock, and check the CPSC's US reporting guidance immediately. When the clock for a report starts depends on what the business learns and when, so ask a qualified adviser now how a report would be made and on what timeline. Address reporting while the investigation and customer remedy proceed. See CPSC duty to report questions.

Triage before you fix

Every return falls into one of five groups. Sort it before you change anything:

- **Safety.** Smoke, heat, injury, or a part that could injure someone. Stop and follow the reporting steps above.
- **Function.** The product does not do what the listing says.
- **Fit and finish.** It works, but a part looks or feels wrong.
- **Use.** The buyer used it outside the instructions or modified it.
- **Unknown.** The report does not yet say enough to sort it.

Ask three questions to place a report: what position was the product in, what exactly happened, and could the same thing happen on another unit? B-037 is a function report with a clear position: the hand caught near the top while the clock stood upright. The next question concerns the lot. Two catches on the hand's clearance from fifty units is 4 in 50, enough to check every upright unit from lot M2 before another leaves. A single return would have been a case to watch.

Ask why until the answer names something you can change. "The hand catches" becomes "the seating depth varies," which becomes "the seating step has no gauge," which points at the traveler, the gauge and the test. Stop when the answer names a part, a step or a check you can change, and record that stopping point on the ticket.

Count returns against a base. Each month, divide returns by units sold for each lot and revision. A count without a base cannot tell you whether a problem is growing. Mara's base for lot M2 is the fifty units in the order, and the count goes on the same sheet as the traveler.

WORKSHEET 11 · SUPPORT TICKET

Leave a record the next builder can use

Copy these lines into your support ticket. Keep a separate open task for any change still needed on the production bench.

Unit, revision and customer's description

Example · B-037, revision B, lot M2. Hand moved during setup and caught near the top while the clock stood upright.

Conditions, cause and affected stock

Example · Flat sweep passed. Upright, the hand touched the face. Correcting movement seating cleared the rub. Review the same lot and accessible stock with Nell.

Customer remedy and total cost

Example · Return arranged. Repaired, retested upright in closed case, owner notified. $12 cash + 20 min labor worth $10 = $22.

What changes for the next shipment, and who verifies it?

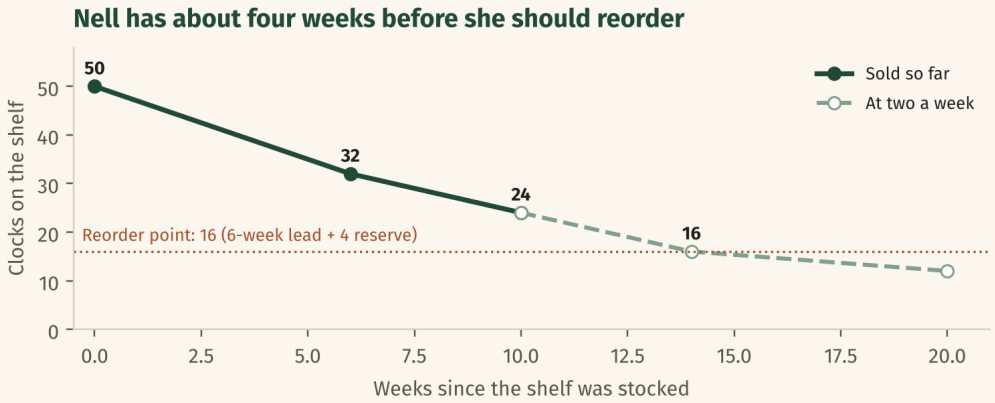
Example · Mara adds an upright sweep to the traveler. Recheck accessible stock before it goes on sale. Record position and observed pass with each release.

Lesson 12 · Reorders

Should I make another batch?

Mara has $1,565 in order cash after buying materials, trial supplies and the extra postage and face. Her time is still in that money. Before, during and after the run, she worked 34 hours. At $30, that takes $1,020. The shop's share takes another $100. Mara can now say what this first order earned after her labor and development: **$445 before tax**. The full ledger accounts for every dollar.

Nell has a different set of numbers. During the first six retail weeks, she sold eighteen, including the four reserved clocks. In the next four weeks she sold eight. After ten weeks that is 26 sold and 24 still on the shelf. Her recent pace is two a week. If another batch takes six weeks and she wants four extra for a busy weekend, **16 left** is the time to discuss replenishment.



Nell's shelf count at two sales a week. Reorder when the count reaches 16.

> You've got twenty-four. If two sell each week, you'll be near sixteen in four weeks. I'll call then. If a festival clears the display sooner, send the actual count and I'll check the schedule.

Mara enters the date in the calendar. Then she does one more piece of arithmetic. Nell might ask for six, or twenty, or another fifty. The fixture is paid for, but the three hours of setup return with every lot. What would Mara be giving up to make the next one?

Six more at the old price?

Six revised clocks at $55 bring $330. Materials and ordinary labor are $36.50 each after the pilot, so six cost $219. Subtract $90 setup and there's $21 left for everything else. The same price that worked at fifty can leave a busy owner working for free on the reorder.

For a new quote, Mara allows one hour, $30, for account work, plus $2 overhead and a $1.20 risk allowance per unit. These are fresh forecasts. The full six cost $358.20. To keep $8 per unit she needs $67.70 each. At Nell's $100

shelf price, that is still above the $55 wholesale price Nell has agreed to, so the small run would need a new conversation.

Try twenty. Twenty at $55 brings $1,100. Deduct $730 in parts and ordinary labor, $90 setup, $30 admin, $40 overhead and $24 allowance. The shop keeps $186. The time commitment before rework is 9 h 20 min building, plus four hours of setup and admin. That crosses into a third six-hour Friday.

Suppose a commission would pay $650 for twelve hours including admin. With $90 materials, $360 owner time and $40 shared expense and allowance, it leaves $160. Mara could earn $26 more from twenty clocks, or finish the commission in two Fridays and keep the third free.

> If twenty suit the shop, I can offer $55 each with the same finish and pickup, subject to an open slot. Six would need $67.70 each to cover the small run. Let's check what you've sold before reserving the time.

Another maker could reply, "I've reserved the next two Fridays for a commission. I'll support the clocks already on your shelf. I can give you a new wholesale date when we check your count." Both makers can show what their decision buys.



What each option leaves for the shop after its own costs. Twenty clocks keep the most.

When the next batch needs a helper

Mara's twenty-clock lot needs 13 h 20 min of owner time, from 9 h 20 min of building plus four hours of setup and admin. That spills into a third Friday. A helper can take some of that time, but a helper costs money, costs training time, and raises insurance and record questions. Test the decision with numbers before writing a job posting.

Suppose a helper does the 14 minutes of hand assembly in each clock and is paid $20 an hour. That step costs $4.67 with the helper. The same 14 minutes costs Mara $7.00 at her $30 rate, so the helper saves $2.33 per clock. Training and supervision cost four helper hours at $20 ($80) and two owner hours at $30 ($60), a total of $140. At $2.33 a clock, the saving repays that in 60 clocks: $140 ÷ $2.33 = 60.

Twenty clocks do not repay the training, and neither do fifty. Sixty do, and each later clock adds to the saving. The helper pays only if the work repeats, and that is the first thing to check. The wage is not the whole cost, either. Before the first paid hour, ask your accountant and insurance agent what a hire requires for your location and for

the way the helper will work. Ask whether the helper will be an employee or a contractor, because the answer changes the records and the insurance question. Mara records those answers in the decision log from Lesson 13.

Consider a step before a person. Outsourcing one step, such as laser cutting the faces, can free owner hours without a payroll decision. Compare the outside price per part with the owner time it replaces, at the same $30 rate you use everywhere else. Lesson 7's laser quote is the same comparison.

Decision rule. Hire when the same hours appear in several orders in a row, when the owner's hours are the bottleneck and not the printer, and when the saving repays training within the volume you can see. Otherwise, price the order higher, offer a smaller lot, or outsource one step.

WORKSHEET 12 · JOB CLOSEOUT

Decide what earns another run

Put the new build time in your cost sheet and the buyer's next count in the calendar. Use the costs known at the review date.

What did the first job earn after my time?

Example · $2,750 sales, $605 after recurring costs, less $160 development = $445 before tax. All 34 owner hours included.

What changes in my estimate?

Example · Use 28 ordinary min instead of 25. The difference was $75. Actual exceptions cost $70 against a $60 allowance.

When is the next buying decision?

Example · 24 left after ten retail weeks. Last four weeks averaged two a week. Six-week lead plus four reserve = 16. Call in four weeks or on a faster sell-through.

What will I offer, and what would make me decline?

Example · Consider 20 at $55 if a third Friday is available. Quote six separately. If the commission takes priority, give Nell a later date and keep supporting existing units.

Part V

Before the product ships

Lesson 13 · Obligations

What could follow the sale?

The clock is boxed, the cartons are counted and the order is paid. Before the first buyer opens the box, Mara lists the obligations that come with selling it. Some are money, some are promises, and some are paperwork. None of them are settled by a good build.

Mara does not need to know the answers to all of these herself. She needs to know which questions she owes an answer to, who can give her that answer and what she has to decide before the first sale. This lesson gives you that list. It states no rules. Each rule depends on where you live, where your buyers live and what your product does, so every item ends with a question to take to someone qualified.

A note on scope

This lesson is an organizing tool, not legal, tax or insurance advice. Bring the questions to an accountant, an insurance agent and, where your terms or claims are involved, a lawyer. Ask them in writing, and keep their answers with the release folder.

Sales tax and fees

Every sale raises the question of where the sale happened and who collects tax on it. Mara's clocks go to a retailer, a direct buyer across town and possibly a marketplace. Each route can answer that question differently.

- **Where is the sale made?** Consider the buyer's location, the shop's location and the place of pickup. Ask whether these change the answer for your products and your state.
- **Wholesale and resale.** If Nell buys for resale, what document does she give you, and how do you keep it on file?
- **Marketplace and platform fees.** Does a platform collect tax for you, charge a fee on the whole sale including tax, or leave both to you?
- **Shipping and handling.** Are these taxed where you sell, and do they appear on the invoice?

Ask: "Which sales of this product, to which buyers, create a tax duty for me, and what records must I keep for each?"

What the answer depends on. Where the buyer takes possession, whether the buyer resells the item, whether the sale is online or in person, and whether shipping or a fee sits on the same invoice. Write these down for each route: direct pickup at the counter, wholesale to Nell, and any marketplace listing.

What to bring to the accountant. A sales list by route, the resale documents held for each wholesale buyer, the platform's fee statements, and one example invoice per route with its tax line shown.

Decision before the first sale. Which routes you will sell through, and who collects and remits tax on each. Mara's working answer: direct sales collected at the counter, wholesale to Nell with her document on file, and no marketplace until the accountant has reviewed its fee structure.

Records and owner pay

Lesson 4 gives you per-unit costs. An accountant also needs to see what the business paid for equipment, what it spent on overhead, and how owner pay is recorded. Keep the same rate, $30 per hour in this book, on your job sheets and in your books so the two tell the same story.

- **Equipment.** Which purchases are expensed when bought and which are depreciated over time? The printer, the fixture and the test gear may be treated differently.
- **Owner pay.** How should your pay and any draw be recorded, and what does the accountant need from your time sheets?
- **Mixed use.** If the printer or a bench also serves commissions or personal projects, how is that share split and recorded?

Ask: "Which of these records do you need from me each month, and in what form?"

What the answer depends on. The purchase price and expected life of each piece of equipment, the split between shop and personal use, and what your books must show for each field. Ask your accountant to list those fields.

What to bring. Purchase receipts for equipment, the job sheets from Lesson 4, a monthly list of shop overhead, and the time sheet behind the owner-pay rate.

Retention. Ask how long each kind of record must be kept, and where. The release folder, the accountant's files and the build records may each have a different answer.

Decision before the first sale. One rate and one set of job codes across the job sheets and the books. Mara uses $30 an hour on both, so a question about her pay can be answered from either.

Liability and insurance

Ask what could go wrong for the person holding the product, not only for the product itself. A failed clock is a refund. A battery that overheats, a glue that irritates skin, a small part a child can swallow or a pinch point in a kinetic toy is a different kind of problem, and it is the kind of risk to take to an insurance agent.

- **Hazard list.** Write down every way the product could injure someone, including through misuse you can foresee. Note which hazards the design removes, which the instructions warn about and which remain.
- **Product liability cover.** Ask an insurance agent whether a policy covers a product you sell, a product sold through a retailer, and a product a customer assembles from a kit.
- **Retailer requirements.** Ask the retailer whether it requires a certificate of insurance and whether it names them as an added party.
- **Modifications.** If a buyer changes the product, who is responsible for what happens next?

Ask: "What does a claim look like for this product, and what would my policy pay for, and not pay for?"

What the answer depends on. Every hazard on your list, the age of the people who will use the product, the materials, the power source, and how each buyer will use or modify it. An insurer will ask the same questions, so answer them in writing once and keep the answers current.

What to bring to the insurance agent. The hazard list, product photographs, the instructions and warnings as sold, the sales channels, and any retailer's insurance requirement, in writing.

Decision before the first sale. Which hazards the design removes, which the instructions warn about, and which you will not sell into. Keep the hazard list current, and update it whenever the design changes.

Terms, warranty and returns

Mara's first reply to Nell already makes promises: the finish, the pickup date, the adapter requirement and what happens if a fault threatens pickup. Written terms turn those promises into something both sides can check. They should be short enough to read and specific enough to apply.

- **What is promised?** Name the warranty period, what it covers and what it excludes, such as customer modifications and power supplies the buyer provides.
- **Who pays for what?** Decide who pays postage for a return, who pays for a repair and whether the remedy is repair, replacement or refund.
- **Which terms win?** If a retailer sends its own terms, decide in advance whether they replace yours, sit alongside them or are rejected.
- **Records of claims.** Each claim should link to a unit number, a lot and a repair record, as in Lesson 11.

Ask: "Which of my promises could a lawyer read more narrowly than I intend, and how should I word them?"

What the answer depends on. The promises already made in listings, cards and emails. Compare them with the written terms. Any gap between the two is a future dispute.

What to bring to the lawyer. The current listing, the card, the box text, the order sheet, your draft warranty, and examples of claims you have handled. Ask for plain-language terms, and keep the final version with the release.

Decision before the first sale. The warranty period you will offer, what it covers, who pays postage on a return, and whether a retailer's terms replace yours or sit alongside them. Mara's draft: one year from pickup for defects, with customer modifications and buyer-supplied adapters excluded, pending review.

Labels, markings and compliance

What is printed on the product, the box and the card is part of the product. The marks a product must carry depend on what it is, who buys it and where it is sold. A toy, a radio device, a product with a battery and a product sold as a gift may each carry different requirements.

- **Consumer product safety.** The CPSC's small business resources are a starting point. Ask which requirements apply to your product category.
- **Radio devices.** If the product contains a radio, ask a qualified reviewer whether the finished configuration needs authorization before sale. The FCC 25-71, the Second Report and Order on the equipment authorization program, is one place to begin. It changes that program, so read it with a reviewer.
- **Batteries, warnings and age grading.** Ask which warnings are required on the package, the card and the listing, and whether an age grade or testing is needed before a product is marketed to children.

- **Origin and identification.** Ask which origin marks, lot codes and contact details the label must carry for your markets.

Ask: "Which markings and warnings must this exact product, box and card carry before a buyer can legally receive it?"

What the answer depends on. The product category, the age grading of the buyer, any battery or radio, the countries where it will be sold, and whether it is sold as a gift. Each choice can change the label.

What to bring. The finished product, the box and card, the listing text, a list of every component with its source, and the country or countries where you will sell.

Decision before the first sale. The final list of markings and warnings for this exact product, and the named person who approved it. Keep that approval with the release record. Mara's version: the adapter requirement on the box and card, and a radio reviewer consulted before any wireless variant is offered.

Keep the proof

Whatever you decide, keep the evidence beside the release. Test records, lot numbers, signed pickup counts, warranty terms as sold, and written answers from advisors belong in the same folder as the build record. When a claim, a return or an inspection arrives, you should be able to show what you promised, what you tested and what you were told.

Keep a decision log

Use one line for each decision, and file the written answer beside it:

Decision	Who answered	Date	Written answer on file	Revisit when
Sales tax routes	Accountant			Any new sales channel
Equipment and owner-pay records	Accountant			Any new equipment purchase
Hazard list and insurance	Insurance agent			Any design change
Warranty, returns and retailer terms	Lawyer			Any new promise in writing
Hiring a helper, employee or contractor	Accountant and insurance agent			Before any paid hour, or any change in how the helper works
Labels, warnings and reviews	Qualified reviewer			Any change to contents, batteries or radio

WORKSHEET 13 · BEFORE THE FIRST SALE

Map what could follow the sale

Complete one line per area before your first direct or wholesale sale. Mark each open question with the person who can answer it and the date you need the answer.

Where is each sale made, and who collects tax on it?

Example · Direct sales in-state, wholesale to Nell with a resale document on file. Question for accountant by March 1.

What could injure someone, and which hazards remain after design?

Example · Small magnet in a kit: remaining hazard, moved to adult-only. Question for insurer and consumer product guidance before sale.

What warranty, return and repair terms will I put in writing?

Example · One-year repair or replacement for defects. Customer modifications and buyer-supplied adapters excluded. Postage paid by the shop on defective returns. Draft for lawyer review.

Which markings, warnings and reviews apply to this product?

Example · Adapter requirement printed on box and card. Radio reviewer contacted before any wireless variant. Lot code on packing slip.

Where will the proof be kept?

Example · Release folder: test records, pickup counts, warranty text as sold, written advisor answers. Reviewed each quarter.

Worked examples and records

Worked examples and records

Worked example · Kits

Thirty shadow theaters for a museum

Imani sells a finished hand-cranked theater. A museum shop wants thirty flat-pack kits at $27. She gives sealed kits to two beginners. Both reverse the front panel. One corrects it. The other breaks a tab. A beautiful, square theater on the counter has concealed the hardest part of the product.

She changes one tab, checks a coupon in production stock and hands a fresh kit to a beginner. This time the builder gets the panel in the right way and makes the first scene move. That is the experience the museum will be selling.

Winterbloom's Big Honking Button is a Eurorack module that buyers can reprogram with CircuitPython to change its behavior and samples, so the customizing is part of what they bought. Which part of your kit is the pleasure people paid for, and which part is a support call waiting to happen?

Who pays for the new silhouette?

Thirty kits	Amount
Kit sales at $27	$810
Parts, packing and ordinary labor	−$540
Setup, shared expense and allowance	−$130
Tab change	−$60
Left for the first run	**$80**

New museum artwork costs two hours plus a $12 proof, $72 altogether. Imani offers the standard scene at $27, or a separate $72 artwork charge after permission and proof approval. Swallowing the change would leave $8 for the whole first run. The cutter already needs nine of ten available hours.

Worked example · Repairs and data

Whose photos survive a repair?

Twelve families want Eli's offline Raspberry Pi frames with the same reunion album. Each family will add its own photos later. When one display needs repair, a cheerful "I'll just reload the card" could lose the only copy of a picture.

Eli uses two spare frames and a photo he owns. He imports the photo on frame A, restarts it and checks that the photo remains. He restores the system on A and checks again. Frame B, built from the clean system master, must never display A's private photo. Finally he runs the owner-transfer procedure on A. Now the photo should be gone.

A temporary root overlay can discard changes on restart. Eli keeps the system master separate from persistent photo storage. He can diagnose a failed import with his own image. Before a customer sends a frame, he agrees what can be erased, how they can keep a copy, and what will happen to any data the shop receives. See the Raspberry Pi documentation on temporary overlays.

What the service promise costs

Twelve frames	Amount
Sales at $160 each	$1,920
Parts and packaging ($78), labor ($20), selling and delivery ($8) per frame	−$1,272
Shared album preparation	−$60
Overhead	−$48
Service allowance ($5.20 per frame)	−$62.40
Forecast after service	**$477.60**

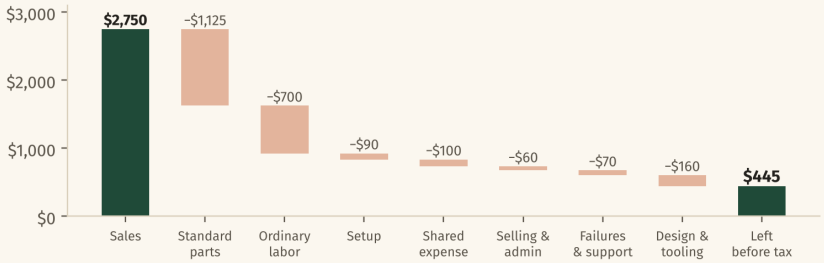
Twelve frames at $160 bring $1,920. Parts, labor and selling come to $106 each, or $1,272, leaving $648. Deduct $60 for the album, $48 overhead and $62.40 for service, and the forecast leaves **$477.60**.

The service allowance comes from two $26 exchanges among ten trial owners, or $5.20 per frame. It is an estimate from a small trial. Eli promises one approved preload and repair by mail, confirms permission to distribute the album and prices later edits separately. Each exchange will replace one more guess about the cost of that promise.

WORKSHEET 11B · SUPPORT TICKET EXAMPLE

Use the same structure as Worksheet 11 when a customer's data is involved: write what was preserved, what was erased, and who confirmed it before the frame went back.

Worked record · Money



Where the $445 came from: sales less every cost of the first order, owner time included.

Where the $445 came from

Use this page when a good bank balance makes a job look better than it felt. All three columns cover the same fifty revised clocks at $55, with pickup. The pilot column changes one assumption. The actual column replaces estimates with results through the review date.

Whole order	Quote	After pilot	Actual
Sales	$2,750	$2,750	$2,750
Standard parts and packaging	−$1,125	−$1,125	−$1,125
Ordinary build labor	−$625	−$700	−$700
Batch setup	−$90	−$90	−$90
Shared expense	−$100	−$100	−$100
Selling and order administration	−$60	−$60	−$60
Failures and support	−$60	−$60	−$70
Left after recurring costs	**$690**	**$615**	**$605**
One-time design and tooling	−$160	−$160	−$160
First-run surplus	**$530**	**$455**	**$445**

What changed? Three extra ordinary minutes across fifty clocks cost $75. Rework and support cost $10 more than the allowance. Together they explain the $85 gap from quote to actual.

Check it against cash. Start with $2,750 received. Take out $1,125 standard materials, $40 tooling supplies, $8 replacement face and $12 service materials and postage. The remaining $1,565 covers $1,020 of owner time and $100 of overhead, leaving $445 before tax.

Would the redesign pay back? Saving seven minutes at $30 an hour is worth $3.50 per clock. The $160 investment needs 46 good clocks to pay back, rounded up. On fifty clocks it saves $175 of ordinary labor. Its other benefit is a batch that fits before pickup.

Worked record · Time and quality

What the batch record remembers

Mara builds order H50 using assembly revision B and firmware clock-1.1. Three units need attention before shipment. One later comes back from a home. Each entry helps a different person find the next piece of work.

Unit	What happened	What Mara records
B-003	Hand caught after tightening.	30 min rework. Correct seating and retest the pilot.
B-021	Face cracked during correction.	20 min and $8. Replace the face and retest.
B-042	Wrong setup card at pack-out.	30 min, including the packing-queue check.
B-037	Passed flat, rubbed upright in use.	20 min and $12. Repair, retest upright, and check remaining stock.

Count what each test tells you. 47 of 50 passed the first production check. All fifty passed the check in use after correction. The later return exposes a gap in that check. Keep it in the support record so you can still see what escaped.

Fit the time back into the week

- **Before the slot.** Four hours developing the revision and one selling. Total 5 h.
- **During five Fridays.** 23 h 20 min ordinary build, 3 h setup, 1 h 20 min rework and 1 h office work. Total 28 h 40 min. Of the 30 h available, 1 h 20 min remained.
- **After pickup.** 20 min for the return. All owner time comes to **34 h**. The printer ran for 58 h 20 min on its own schedule.

Check the $70 exception cost

The three pre-shipment fixes cost $40 of labor plus an $8 face. Field support added $10 of labor and $12 cash. Charge those actual costs in place of the $60 allowance.

Other ways to sell

When wholesale isn't the right fit

The wholesale order buys five Fridays of Mara's attention. What might those Fridays earn in another channel? Use the buyers you can actually reach.

A direct sale

Mara's original $85 clock costs $40 to build. Selling and fulfillment add $6 in expenses and $4 of her time. That leaves $35 for setup, shared expense, risk and profit. Twelve such sales contribute $420 before those costs. She has sold twelve. Assuming fifty direct buyers are waiting would turn a comparison into a wish.

A custom coastline

At $125, the original clock uses the same $40, plus $9 special stock, $7.50 extra handling and $60 to draw and approve the art. The first one leaves $8.50 before overhead and selling costs. Six copies of one approved drawing share the $60. Six coastlines commissioned by six families would each require approval. List the drawing and any included review round on the quote.

A referral from Nell

A $10 referral on a completed $85 direct sale brings Mara's contribution down to $25. Twelve such sales yield $300, or $210 after a $90 setup, before overhead and risk. Two sales bring $50, which doesn't cover the $90 setup. Wait for enough commitments, or use a batch already planned.

A Saturday at a fair

Table and travel cost $180. At $30 left per sale after unit-specific costs, six sales cover those bills. Eight hours of Mara's Saturday at $30 add $240. Now fourteen sales cover the $420 commitment. If she goes to meet retailers, she writes down which buyers she wants to meet and what follow-up would justify the day.

In your shop

Ten minutes before you leave on Friday

Pick the last promise you made to a buyer. Open the message, then put your latest note from the bench beside it. Did you learn anything this week that changes the price, the date or what that person will receive?

When this happens	Add one entry	Where it earns its keep
A buyer asks for fifty	Quantity, version and date goods are needed	Email and calendar
One good unit is boxed	Measured ordinary minutes and any extra time	Cost estimate
A part or file changes	First affected unit and the test that must pass again	Release folder
A unit comes back	Symptom in use, remedy and the change for later units	Support ticket and build sheet
A retailer asks for more	Remaining stock and price at the requested quantity	Reorder email

Try a five-minute rehearsal

- **A buyer holds at $45.** Say what you would send if they will change the quantity but want the original finish. Check your answer against the forty-unit calculation. If forty still lose money at their price, put the pencil down and say so.
- **A pilot unit catches.** Use the five measured times and the separate repair on the pilot sheet. Write the single number that tells Nell when her pickup is at risk. Put the remaining rework minutes on the live order.
- **Your product has no clock hand.** Pick an action somebody actually buys your kit or frame to perform. Give them a sealed sample, step back, and record the first place they need you. Put that observation beside the drawing, software or sentence you intend to change.

Mara leaves her shop sample standing upright beside the new test card. When Jules asks why the last sweep runs that way, she turns the card over. The unit number is on the back, next to the owner's words: "catches near the top."

Reference shelf

Sources to open when you need them

Mara, Nell, Imani and Eli are fictional. Their prices, shop hours and test outcomes are teaching examples. The resources below come from the named organizations and makers.

Product claims and customer safety

- NOAA on tidal cycles, which Mara uses to explain the limits of an ornamental fixed-cycle dial.
- NOAA station predictions.
- CPSC small business resources and duty-to-report questions.
- FCC FCC 25-71, Second Report and Order on the equipment authorization program (ET Docket 21-232). For a radio-equipped variant, take the intended module, antenna, enclosure and markets to someone qualified to review the finished configuration.

Pricing and rights

- US Small Business Administration break-even calculator. Try your own fixed and per-unit costs in it.
- Open Source Hardware Association definition.

For artwork, software and hardware, keep the actual licenses, versions, permissions and notices beside the files you release.

From published workshops

- Michael Parks, *Empower Emotions in the Physical World*, for Mouser.
- Adafruit, testing fixture demonstration.
- Winterbloom, Big Honking Button, a Eurorack module designed by Alethea Flowers, with CircuitPython firmware support.
- Raspberry Pi, configuration and the overlay filesystem, which documents what the temporary overlay discards at reboot.

Appendix

Forms and working numbers

Everything you need to run the lessons on paper or in your own files. Use the index to find each form, print the blank forms, and keep the working numbers and terms beside your calculator.

A · Form index

No.	Form	Found in
1	**Shop calendar** Reserve the time you can sell	Lesson 1 · Before you promise
2	**Buyer notes** Record what one buyer actually did	Lesson 2 · Before you promise
3	**Release brief** Check what the box promises	Lesson 3 · Before you promise
4	**Cost estimate** Cost one unit and one batch	Lesson 4 · Costing
5	**Price list** Find the overlap in dollars	Lesson 5 · Pricing
6	**Quote email** Draft the reply you will send	Lesson 6 · Quoting
7	**Sourcing decision** Record why this method won	Lesson 7 · Production
8	**Build instructions** Capture the first snag	Lesson 8 · Production
9	**Release record** Record the decision to continue	Lesson 9 · Release
10	**Retailer order sheet** Give the retailer one usable order line	Lesson 10 · Selling
11	**Support ticket** Leave a record the next builder can use	Lesson 11 · Support
12	**Job closeout** Decide what earns another run	Lesson 12 · Reorders
13	**Before the first sale** Map what could follow the sale	Lesson 13 · Obligations

B · Blank forms

Each form below matches a worksheet in the lessons, without the example answers. Print one per job, or copy the questions into your own record.

WORKSHEET 1 · SHOP CALENDAR

Reserve the time you can sell

Make these entries in the calendar or job note you will consult before promising a date. The example uses the original clock.

Which days and commitments am I protecting?

What must reach the buyer, and when do I stop building?

What fits after setup and office work?

How much can I spend before payment, and what requires a call?

WORKSHEET 2 · BUYER NOTES

Record what one buyer actually did

Keep this in the buyer's email thread or beside the listing. Record the price shown, even when nobody buys.

Who saw which offer, and where?

What did a buyer expect the product to do?

What commitment changed hands?

What decision can I take now, and what would change it?

WORKSHEET 3 · RELEASE BRIEF

Check what the box promises

Lay your listing, a sealed sample and its instructions side by side. Send discrepancies to the person who decides whether this version goes on sale.

What will this customer be able to do?

What is packed, and what must the buyer bring?

Which promise can someone test without me?

What would hold this version, and who decides?

WORKSHEET 4 · COST ESTIMATE

Cost one unit and one batch

Copy these entries into your estimate. The examples price the original fifty before the design change.

Parts and packing per good unit

Ordinary labor and machine occupancy

Setup for this run

Shared expense and its basis

Time spent selling and handling the order

Allowance for failures and service

WORKSHEET 5 · PRICE LIST

Find the overlap in dollars

Use the same revision and quantity on both sides of your calculation. This example is for the original fifty with local pickup.

What does the whole run cost, including my time?

What price gives me the return I want?

How much can the buyer pay, including inbound freight?

What can I offer at that price and on that date?

WORKSHEET 6 · QUOTE EMAIL

Draft the reply you will send

Write the four parts of one message. Use the calendar you share with the buyer for every date.

Item, revision, quantity and box contents

Price, separate charges and total

Approval, payment and delivery dates

What changes the promise, and how will they hear?

WORKSHEET 7 · SOURCING DECISION

Record why this method won

File the result with the drawing, sample and supplier quote. The example uses the fifty-housing comparison.

Part and acceptance condition

Delivered cost at the quantity I can sell

What measurement could reverse the ranking?

What did the sample show, and what will I buy?

WORKSHEET 8 · BUILD INSTRUCTIONS

Capture the first snag

Save the revised instruction and test result in the release folder. Keep one line per unit in the record that travels with the product.

What did I hand the second builder?

What did the builder do, and what allowed it?

What changed in the part and instructions?

What did the fresh builder and the sample prove?

WORKSHEET 9 · RELEASE RECORD

Record the decision to continue

Use this sheet for the pilot decision. In the build record, keep the result against every unit that ships.

Which product and units are under review?

What did the test require, and what failed?

How much work did it take, including rework?

What can proceed, and what is still on hold?

What will the buyer hear?

WORKSHEET 10 · RETAILER ORDER SHEET

Give the retailer one usable order line

Put this on a retailer line sheet or in a saved reorder email. The listing and shelf copy above answers the questions a gift buyer is likely to ask.

Product, code and release

Contents and buyer-supplied item

Terms for this order

How does a store employee reorder?

WORKSHEET 11 · SUPPORT TICKET

Leave a record the next builder can use

Copy these lines into your support ticket. Keep a separate open task for any change still needed on the production bench.

Unit, revision and customer's description

Conditions, cause and affected stock

Customer remedy and total cost

What changes for the next shipment, and who verifies it?

WORKSHEET 12 · JOB CLOSEOUT

Decide what earns another run

Put the new build time in your cost sheet and the buyer's next count in the calendar. Use the costs known at the review date.

What did the first job earn after my time?

What changes in my estimate?

When is the next buying decision?

What will I offer, and what would make me decline?

WORKSHEET 13 · BEFORE THE FIRST SALE

Map what could follow the sale

Complete one line per area before your first direct or wholesale sale. Mark each open question with the person who can answer it and the date you need the answer.

Where is each sale made, and who collects tax on it?

What could injure someone, and which hazards remain after design?

What warranty, return and repair terms will I put in writing?

Which markings, warnings and reviews apply to this product?

Where will the proof be kept?

C · Working numbers

These are the formulas the lessons use. Replace the example figures with your own, and keep the same units throughout.

Figure	Formula	Example
Owner-pay rate	Annual owner-pay target ÷ hours you can charge to jobs	$36,000 ÷ 1,200 = $30/h
Ordinary labor per unit	Minutes per unit × rate ÷ 60	35 × $30 ÷ 60 = $17.50
Boxed unit cost	Parts and packing + ordinary labor + shared expense per unit	$22.50 + $17.50 = $40.00
Batch cost	Units × unit cost + setup + shared expense + selling + allowance	$2,310 for fifty
Break-even price per unit	Batch cost ÷ units	$2,310 ÷ 50 = $46.20
Fee gross-up	Net amount you want ÷ (1 − fee rate)	$54.20 ÷ 0.95 = $57.06
Wholesale price	Retail price × (1 − retailer's share)	$100 × 55% = $55
Time available for a batch	Hours in slot − setup − office − reserve for trouble	30 − 3 − 1 − 2h40 ≈ 23h20
Units that fit	Available minutes ÷ minutes per unit	1,400 min ÷ 35 = 40
Payback units for a design change	One-time cost ÷ saving per unit	$160 ÷ $5 = 32
Reorder point	Weekly sales × lead time in weeks + safety reserve	2 × 6 + 4 = 16
Shared expense share	Pool × your hours ÷ total planned hours	$120 × 58h20 ÷ 70h ≈ $100

D · Glossary

Terms as this book uses them. Where a trade or regulator uses a different meaning, follow theirs.

Term	Meaning here
Allowance	An amount set aside per unit or per batch for rework, failures, and support, replaced by actual costs at review.
Batch	One run of identical units, built, tested and released together.
Carton range	The inclusive unit numbers packed in each outer carton, such as B-011 to B-020.
Commission	A one-off piece made to a customer's request, quoted separately from stock runs.
Landed cost	What a buyer pays to have the product on hand, including freight and any handling charge.
Lot	A group of parts from one supplier shipment, recorded so that a fault can be traced to it.
Ordinary minutes	Time for a unit under normal conditions, excluding rework and investigation.
Owner pay	The rate and hours recorded for your own time on jobs; it is a cost of the work, not what is left after it.
Pilot	The first small set of units checked before the rest of the batch is released.
Release	A specific, approved version of a product: its design, firmware, instructions, card and box contents.
Revision	A dated, numbered change to a design, part, instruction or label. Each revision has its own record.
Service sweep	A quick bench mode that moves the hand all the way round, used to find rubbing; it does not test normal timing.
Setup	One-time work to prepare a batch: files, fixtures, staging and test set-up.
Shared expense	Machine and shop costs spread across jobs by a stated basis, such as printer hours.
Traveler	The record that follows a unit or batch through production, carrying its checks and changes.

E · Further reading

Books and sources that cover the same ground from other angles. Read them alongside this guide, and check any details against the current edition.

- **Maker Pro: Essays on Making a Living as a Maker** (Make: Community, 2014). Essays and interviews by professional makers, several of whom left their day jobs. Useful on constraints, supply chains and finding mentors.