Trading costs and electronic markets

Portfolio Construction

1 A story: the price on the windscreen

- Ines Calloway trades for Harrow Pension Fund
- The confirmation shows only the commission
- Hidden costs sit inside the price paid
- Judge a trade by its total cost

IN THE LESSON

- Imagine you buy a car.
- The dealer shows a price on the windscreen.
- You agree, and then the extras arrive: the paperwork, the delivery, the weeks of waiting.
- The price you paid was not the price you saw.
- A trade works the same way.
- Ines Calloway sends an order for Harrow Pension Fund, and the broker sends back a confirmation.
- It shows one cost clearly, the commission.
- But the real bill is bigger.
- Some of it sits inside the price at which the shares changed hands.
- Some of it comes from the price moving while the order waited.
- And some comes from shares that were never bought.
- The fund pays all of it, so the exam expects you to count all of it.

2 Visible and hidden costs of one trade

Two families of cost

Cost	Kind
Commission	Explicit
Exchange, clearing fees, taxes	Explicit
Spread and market impact	Implicit
Delay and opportunity cost	Implicit

IN THE LESSON

- Costs come in two families.
- Explicit costs are written on the trade record.
- The commission is the broker's fee.
- Then come the exchange and clearing fees, and any transaction tax the government adds.
- You can read all of these off the invoice.
- Implicit costs appear on no invoice at all.
- The first group is the spread and market impact.
- The spread is the gap between what buyers will pay and what sellers will accept, and an order that crosses it pays it.
- Market impact is the extra the price moves because your order is big.
- The second group is delay and opportunity.
- Delay cost is the price drifting away while you wait.
- Opportunity cost is the gain lost on shares you never managed to trade.

3 The trade-off: rush or wait

Chart: Cost (basis points) vs How slowly the order is traded

- Market impact
- Delay and missed fills
- Lowest total cost

IN THE LESSON

- Here is the trade off every trader faces.
- The horizontal axis is how slowly the order is traded, from a rush on the left to a patient crawl on the right.
- The vertical axis is cost, in basis points, where one basis point is one hundredth of one per cent.
- Follow the red curve first.
- It is market impact.
- Rush the order and you push the price against yourself, so impact is high on the left and falls as you slow down.
- The green curve is delay and opportunity cost.
- It is low when you rush and climbs as you wait, because prices drift and orders go unfilled.
- The dark curve is the two added together.
- It is lowest in the middle, and that speed is what a good trader aims for.

4 Example 1: two brokers, one order

Buy 40m. Alder: commission 3, hidden 34. Birch: 7, 18

Alder, total cost	3 + 34	**37 bps**
Birch, total cost	7 + 18	**25 bps**
Alder, in money	40m × 0.37%	**148,000**
Birch, in money	40m × 0.25%	**100,000**
Birch is cheaper by	148,000 − 100,000	**48,000**

IN THE LESSON

- Now put numbers on it.
- Harrow wants Ines Calloway to buy forty million of shares, and two brokers compete for the order.
- Broker Alder charges three basis points of commission, but its execution costs thirty four basis points in spread, impact and delay.
- Broker Birch charges seven, and its execution costs eighteen.
- Add each pair.
- Alder totals thirty seven basis points and Birch totals twenty five.
- In money, Alder costs one hundred and forty eight thousand and Birch costs one hundred thousand.
- Birch is cheaper by forty eight thousand, even though its commission is more than double.
- These figures are made up, but the pattern is exactly the one the exam loves to test.

5 Visible against hidden

Cost (basis points)

Alder: visible	**3**
Alder: hidden	**34**
Birch: visible	**7**
Birch: hidden	**18**

Same order, two brokers

IN THE LESSON

- Here are the same two brokers as bars.
- The vertical axis is cost in basis points.
- The first bar is Alder's visible cost, the commission, three.
- It is a thin sliver.
- The second bar is Alder's hidden cost, thirty four, a tower.
- The third and fourth bars are Birch: a visible commission of seven, and a hidden cost of eighteen.
- Compare the thin bars alone and Alder wins easily.
- Compare the tall bars and Birch wins easily, and the tall bars are far bigger.
- This is the classic trap, judging a broker by commission alone.
- A cheap broker with poor execution turns out to be expensive.
- Always add the hidden part before you choose.

6 Where hidden costs bite hardest

- Large orders move the price as they trade
- Urgent orders pay for speed with impact
- Thin, illiquid shares have wide spreads
- Patient orders risk delay and missed fills

IN THE LESSON

- Which orders suffer most from hidden costs?
- Large orders do, because they move the price as they trade.
- Urgent orders do, because rushing pays for speed with market impact.
- Shares that rarely trade do too, because the market is thin and the spread is wide.
- Patient orders avoid impact, but they risk delay and missed fills, as the curve showed.
- So when Ines Calloway receives a big order in a thinly traded share, she expects the hidden costs to dwarf the commission.
- She plans the whole trade around them, and not around the invoice, and she tells the client why.

7 A story: the screen and the till

- Quoted spread: ask minus bid on the screen
- Midpoint: halfway between bid and ask
- A trade lands inside, at, or outside the quote
- Effective spread: what the trade really paid

IN THE LESSON

- Back to the screen.
- A trader sees a bid, the best price a buyer is offering, and an ask, the best price a seller wants.
- The gap is the quoted spread.
- The midpoint sits halfway between them, and it is the simplest guess at fair value.
- Now a trade happens.
- It might be at the ask, which costs the full half spread.
- It might land inside the quote, which is better.
- Or it might land outside the quote, which is worse.
- The effective spread asks one question: how far from the midpoint did this trade really happen?
- It measures the answer in a way that can be compared with the quoted spread.

8 The effective spread

Effective spread = 2 × abs(trade − midpoint)
Midpoint = (bid + ask) ÷ 2

Trade price	Price the trade was done at
Midpoint	Halfway between bid and ask
Quoted spread	Ask minus bid, on the screen
Effective spread	Twice the distance from midpoint

IN THE LESSON

- Here is the formula.
- Take the trade price and subtract the midpoint.
- Ignore the sign, because we care only about the distance.
- Then multiply by two.
- Why two?
- The quoted spread is a full trip from the bid to the ask.
- The distance from the midpoint is only half of that, so doubling it puts the effective spread on the same footing as the quoted one.
- A buy exactly at the ask gives an effective spread equal to the quoted spread.
- A smaller number means price improvement, and a larger number means the trade was filled outside the quote.
- The same arithmetic works for sales, because of the absolute value.

9 Example 2: Brannock Foods

Brannock Foods: bid 31.20, ask 31.30

Midpoint	(31.20 + 31.30) ÷ 2	**31.25**
Quoted spread	31.30 − 31.20	**0.10**
Buy at 31.28: effective	2 × abs(31.28 − 31.25)	**0.06**
In basis points	0.06 ÷ 31.25	**19.2 bps**
Buy at 31.31: effective	2 × abs(31.31 − 31.25)	**0.12**

IN THE LESSON

- Ines Calloway buys shares of Brannock Foods when the bid is thirty one point two zero and the ask is thirty one point three zero.
- The midpoint is thirty one point two five, and the quoted spread is point one zero.
- She buys at thirty one point two eight.
- That is point zero three above the midpoint, so the effective spread is two times point zero three, which is point zero six.
- It is smaller than the quoted spread, so she received price improvement.
- Divide point zero six by the midpoint and you get nineteen point two basis points.
- Had the trade been done at thirty one point three one, outside the quote, the effective spread would be point one two, worse than the screen promised.

10 Quoted against effective

Cents per share

Quoted spread	**10**
Effective: inside	**6**
Effective: outside	**12**

Brannock Foods, bid 31.20, ask 31.30

IN THE LESSON

- Here are those spreads as bars, in cents per share, on the vertical axis.
- The first bar is the quoted spread, ten cents.
- That is what the screen advertised.
- The second bar is the effective spread of the trade inside the quote, six cents.
- It is shorter, which is price improvement, and shorter is better.
- The third bar is the effective spread of the trade outside the quote, twelve cents.
- It is taller than the quote, so the buyer paid more than advertised.
- One number tells you whether a trade beat the screen or lost to it.
- The trap is forgetting the factor of two, which would halve every effective bar and make a poor fill look perfectly fine.

11 VWAP cost of a whole order

VWAP cost (bps) = side × (average − VWAP) ÷ VWAP × 10,000

Average price	Fills weighted by their size
Market VWAP	Market average, same window
Side of trade	+1 for a buy, −1 for a sale
Cost in basis points	Positive means a cost to you

IN THE LESSON

- A single trade is not a whole order.
- Institutions work big orders over hours, in many fills.
- To judge that, we compare the order's average price with V W A P.
- That stands for the volume weighted average price: the average price of every trade in the market over the same period, with each price counted in proportion to the volume traded at it.
- First find your own average price, weighting each fill by its size.
- Then take the gap to V W A P, divide by V W A P, and multiply by ten thousand to get basis points.
- The side matters.
- For a purchase the sign is plus one, since paying more than the market average is a cost.
- For a sale the sign is minus one.

12 Example 3: buying against VWAP

Buy 80,000: 50,000 at 18.60, 20,000 at 18.70, 10,000 at 18.80

Total spent	fills × their prices	**1,492,000**
Average price	1,492,000 ÷ 80,000	**18.65**
Market VWAP	same window	**18.57**
Cost in basis points	(18.65 − 18.57) ÷ 18.57	**43.1 bps**
Cost in money	80,000 × 0.08	**6,400**

IN THE LESSON

- Ines Calloway buys eighty thousand shares of Orrin Marine for Harrow in three fills: fifty thousand at eighteen point six zero, twenty thousand at eighteen point seven zero, and ten thousand at eighteen point eight zero.
- The money spent is one million four hundred and ninety two thousand.
- Divide by eighty thousand shares and the average price is eighteen point six five.
- The market V W A P over the same window was eighteen point five seven.
- The gap is point zero eight.
- Divide by eighteen point five seven and you get forty three point one basis points.
- In money, eighty thousand shares times point zero eight is six thousand four hundred.
- That is the price of buying above the market's average.

13 Example 4: selling against VWAP

Sell 60,000 at an average 52.30; VWAP 52.50

Side of the trade	a sale, so sign is −1	**−1**
Price gap	52.30 − 52.50	**−0.20**
Cost in basis points	−1 × (−0.20) ÷ 52.50	**38.1 bps**
Cost in money	60,000 × 0.20	**12,000**
Buy sign by mistake says	a gain of 38.1 bps	**Trap**

IN THE LESSON

- Now a sale, because this is where marks are lost.
- Later Ines Calloway sells sixty thousand shares of Ketterly Foods at an average of fifty two point three zero, while the V W A P was fifty two point five zero.
- Selling below the market average is a cost.
- The sign for a sale is minus one.
- The price gap is minus point two zero.
- Minus one times minus point two zero, divided by fifty two point five zero, gives thirty eight point one basis points.
- In money, sixty thousand times point two zero is twelve thousand.
- If you used the buy sign by mistake, the answer would show a gain, and a poor sale would look like a good one.
- So always check the side first.

14 What VWAP cannot tell you

- Spreading trades through the day can game it
- It ignores shares that were never filled
- A big order drags VWAP toward its own price
- Close to VWAP does not mean good timing

IN THE LESSON

- V W A P is popular because it is easy to compute and easy to explain.
- But it has weaknesses.
- A trader can game it.
- By spreading trades across the whole day, the trader's average drifts toward the market's average almost automatically, so a score near zero says little.
- It also ignores unfilled orders.
- A trader who buys only the cheap shares and abandons the rest looks good, while the fund misses the rise.
- When the order is a big part of the day's volume, the V W A P is partly the order's own doing, so beating it proves less.
- And a good score does not prove good timing.
- Next we meet a measure that answers these complaints.

15 A story: the paper portfolio

- Decision: buy 50,000 shares at 40.00
- Order reaches the desk at 40.15
- Filled 40,000 at an average of 40.45
- Cancelled 10,000 at 41.00; fees 1,200

IN THE LESSON

- Here is the thought experiment behind implementation shortfall.
- Imagine a paper portfolio.
- The moment the manager decides to buy, the paper portfolio buys everything instantly at the decision price, with no fees and no delay.
- Then there is the real portfolio, the one that actually gets built.
- The difference between them is the true cost of turning an idea into a position.
- Take Harrow's manager.
- She decides to buy fifty thousand shares at forty.
- The order reaches the desk when the price is forty point one five.
- The desk fills forty thousand at an average of forty point four five, then cancels the last ten thousand when the price reaches forty one.
- Fees come to one thousand two hundred.

16 The three parts of the shortfall

The timeline

Decision price on paper → Order reaches the desk → Fills at market prices

The bill

Execution cost: shares bought → Opportunity cost: shares missed → Fees: commissions

IN THE LESSON

- The shortfall has three parts, and a flow makes them easy to see.
- The top row is the timeline.
- The decision price is where the paper portfolio trades.
- The order then reaches the desk, and the market fills what it can, at the prices it gives.
- The bottom row is the bill.
- Execution cost is what you lost on the shares you did buy, measured against the decision price.
- Opportunity cost is what you lost on the shares you did not buy, because the price ran away.
- Fees are the commissions.
- Notice that the delay between decision and arrival sits inside the first two costs, because we always start the clock at the decision.

17 Implementation shortfall

Shortfall = execution + opportunity + fees
In bps = shortfall ÷ paper × 10,000

Execution cost	Filled × (average − decision)
Opportunity cost	Unfilled × (final − decision)
Fees	Commissions and fees paid
Paper investment	Order size × decision price

IN THE LESSON

- Here is the formula for a purchase.
- Execution cost is the shares filled, times the gap between the average fill price and the decision price.
- Opportunity cost is the shares not filled, times the gap between the price when you gave up and the decision price.
- Add the fees.
- That total is the shortfall.
- To compare orders of different sizes, divide by the paper investment, which is the full order size times the decision price, and quote basis points.
- For a sale, flip the gaps so that selling lower is a cost.
- The key word is decision.
- The price that starts the clock is the price at decision, not the price at arrival or at the first fill.

18 Example 5: the shortfall in money

Paper investment: 50,000 × 40.00 = 2,000,000

Execution cost	40,000 × (40.45 − 40.00)	**18,000**
Opportunity cost	10,000 × (41.00 − 40.00)	**10,000**
Fees	commissions	**1,200**
Total shortfall	18,000 + 10,000 + 1,200	**29,200**
As basis points	29,200 ÷ 2,000,000	**146 bps**

IN THE LESSON

- Now the numbers.
- The paper investment is fifty thousand times forty, which is two million.
- Execution cost: forty thousand shares were filled at forty point four five, against forty.
- The gap is point four five, so the cost is eighteen thousand.
- Opportunity cost: ten thousand shares were not bought, and the price reached forty one, a gap of one.
- That is ten thousand.
- Fees are one thousand two hundred.
- Add them up and the shortfall is twenty nine thousand two hundred.
- Divide by two million and you get one point four six per cent, which is one hundred and forty six basis points.
- A measure that looked only at the shares filled would have missed ten thousand of the cost.

19 Where the shortfall came from

Cost (dollars)

Execution	**18,000**
Opportunity	**10,000**
Fees	**1,200**
Total	**29,200**

Harrow's purchase, measured from the decision price

IN THE LESSON

- Here are the pieces as bars, in money, on the vertical axis.
- The first bar is execution cost, eighteen thousand.
- The second is opportunity cost, ten thousand, the shares that got away.
- The third is the fees, one thousand two hundred, which is a mere sliver beside the others.
- The fourth bar is the total, twenty nine thousand two hundred.
- Look at the third bar again.
- Commission is the part everyone argues about in a fee negotiation, yet here it is tiny, and the second bar is a cost that many measures never see.
- That is the strength of implementation shortfall.
- It captures every cost, including the unfilled order, and so it gives the whole bill.

20 Example 6: the arrival price trap

Same order, wrongly measured from arrival at 40.15

Execution from arrival	40,000 × (40.45 − 40.15)	**12,000**
Opportunity from arrival	10,000 × (41.00 − 40.15)	**8,500**
Fees	unchanged	**1,200**
Total from arrival	12,000 + 8,500 + 1,200	**21,700**
Delay cost hidden	50,000 × (40.15 − 40.00)	**7,500**

IN THE LESSON

- Now the trap the exam sets.
- Suppose someone measures the same order from the arrival price of forty point one five instead of the decision price.
- Execution cost becomes forty thousand times point three zero, which is twelve thousand.
- Opportunity cost becomes ten thousand times point eight five, which is eight thousand five hundred.
- Fees stay at one thousand two hundred.
- The total is twenty one thousand seven hundred, which looks better.
- But the true figure was twenty nine thousand two hundred.
- The difference is seven thousand five hundred.
- That is fifty thousand shares times the fifteen cents the price rose while the order sat waiting.
- It is a real cost of the process, so it belongs in the shortfall.

21 Three measures side by side

What each measure compares with

Measure	Compared with
Effective spread	Midpoint
VWAP cost	Average price
Implementation shortfall	Decision price
Counts unfilled shares?	Only shortfall

IN THE LESSON

- Here is the family side by side.
- Effective spread compares one trade with the midpoint at that moment.
- V W A P cost compares the order's average price with the market's average price.
- Implementation shortfall compares the real result with a paper trade at the decision price.
- The last row is the big difference.
- Only shortfall counts shares that never traded.
- Which one to use depends on the question.
- Was this fill good?
- Was the order near the market?
- Or what did the idea really cost to carry out?
- Shortfall is the most complete, which is why portfolio managers use it to judge the whole process.

22 Mistakes to avoid so far

- Judging a broker by commission alone
- Forgetting the factor of two in effective spread
- Using the buy sign for a sale against VWAP
- Starting shortfall at arrival, not at the decision
- Ignoring the shares that never traded

IN THE LESSON

- Let us collect the common mistakes from the first three topics.
- One: judging a broker by commission alone, and missing the hidden costs.
- Two: forgetting the factor of two in the effective spread, which makes every trade look twice as good.
- Three: using the buy sign for a sale when measuring against V W A P, so a cost turns into a gain.
- Four: starting the shortfall at the arrival price, when it must start at the decision price.
- And five: ignoring the shares that never traded, when their opportunity cost can be as big as the cost of the shares that did.

23 A story: from the floor to the machine

- Old floors: people shouting and writing tickets
- Now computers match buyers and sellers
- Cheaper, faster, and every step recorded
- Cheaper quotes may not mean a cheaper order

IN THE LESSON

- Not long ago, trading meant a crowded floor.
- People shouted, waved and wrote tickets.
- Dealers held shares in their own books, and every step needed a human.
- Today most orders are matched by computers.
- Why?
- Think of a post office that replaces a hall of clerks with one machine.
- It is cheaper, it never mixes up an address, and it keeps a record of every parcel.
- That is the first reason.
- There are others, including the rules and the customers.
- And the story ends with a twist, because we must test whether cheaper trading really means a cheaper bill for Harrow.

24 Why trading went electronic

Why it happened

Cheaper, faster, recorded → Rules: compete, best execution → Demand: algorithms

What was left behind

Tighter spreads and fees → Scattered liquidity → Faster rivals

IN THE LESSON

- Read the top row first.
- It shows why trading changed.
- The first box is cost.
- Computers match orders more cheaply than floor traders and dealers, they are faster and more accurate, and they leave a complete record of every order, which helps regulators and compliance teams.
- The second box is rules.
- Regulators encouraged venues to compete and required best execution, which favours systems that can search across venues.
- The third box is demand.
- Institutions trade more, and their algorithms, which are programs that slice and time orders, need speed.
- Now the bottom row, what a manager inherits.
- Spreads and fees are tighter.
- But liquidity is scattered, and faster rivals can spot big orders.
- That bottom row is where the trap hides.

25 Four forces, three reasons

Four forces behind electronic trading

Force	Effect
Cheaper matching	Lower cost
Speed and audit trail	Fewer errors
Competition, best execution	More venues
Institutions, algorithms	Automation

IN THE LESSON

- Let us walk through each force.
- Cheaper matching comes first: computers handle an order for a tiny fraction of what floor staff cost, so the cost per trade fell.
- Next, speed and the audit trail: machines reduce errors in execution and settlement, and every step is recorded.
- Then competition and best execution: regulators encouraged rival venues and required that orders go where the price is best, so systems able to route across venues won.
- Last, institutions and algorithms: as institutional trading grew, and technology got cheaper, automation paid for itself.
- No single force did it.
- They reinforced each other, and together they made electronic trading the norm.

26 Example 7: Tidewater's costs, before and after

Commission + half-spread + market impact, in bps (illustrative)

Before: floor era	10 + 6 + 14	**30 bps**
Now: electronic	4 + 3 + 21	**28 bps**
Visible costs saved	(10 + 6) − (4 + 3)	**9 bps**
Market impact added	21 − 14	**7 bps**
Net saving	9 − 7	**2 bps**

IN THE LESSON

- Here is a small illustration for Tidewater.
- Say that on large orders, before the move to electronic markets, the costs were commission ten basis points, half the spread six, and market impact fourteen, thirty in all.
- The half spread is what a single trade pays to cross.
- Now the costs are four, three and twenty one, twenty eight in all.
- The visible costs, commission and half spread, fell from sixteen to seven, a saving of nine.
- But market impact rose by seven, because liquidity is thinner on each venue and faster traders react to big orders.
- The net saving is only two basis points.
- The spread halved, but the bill barely moved.
- Made up numbers, but a real lesson.

27 Visible savings, hidden rise

Cost (basis points)

Visible: before	**16**
Visible: now	**7**
Impact: before	**14**
Impact: now	**21**

Illustrative costs on large orders

IN THE LESSON

- Here is the same story as bars.
- The vertical axis is cost in basis points.
- The first bar is the visible cost before, commission plus half spread, sixteen.
- The second is the same cost now, seven.
- A big drop, and it is what the headlines celebrate.
- The third bar is market impact before, fourteen.
- The fourth is market impact now, twenty one, taller.
- Much of the saving on the left was handed back on the right.
- So lower quoted spreads do not mean lower total trading costs.
- For a small order that trades at the best quote, the savings are real.
- For a large order, the impact bar usually decides.

28 The trap: narrow quotes, big bill

- Quoted spreads describe small trades only
- Big orders also pay impact, delay and misses
- Liquidity is scattered across many venues
- Faster rivals can see and trade ahead
- Slice, route, hide intent, and measure shortfall

IN THE LESSON

- So here is the trap.
- Someone says quoted spreads have halved, so our trading costs must have halved.
- That reasoning counts only the cost of a small trade at the best price.
- A large order eats through the visible depth and pays impact.
- It may be spotted by faster traders who trade ahead of it.
- It may have to chase liquidity across many venues.
- What can a manager do?
- Use algorithms that slice the order, route across venues and hide intentions.
- Match the speed to the urgency, and be patient where the idea allows.
- And measure the result with shortfall, not just the quote.
- Electronic trading is a gain, but it is not a free lunch.

29 Recap: the lesson in five lines

- Costs: commission, fees, taxes; spread, impact, delay, misses
- Effective spread = 2 × abs(trade − midpoint)
- VWAP cost: side × (average − VWAP) ÷ VWAP
- Shortfall: execution + opportunity + fees, from decision
- Electronic: cheaper and faster, but liquidity scatters

IN THE LESSON

- Let us pull the lesson together.
- First, a trade has explicit costs, the commission, fees and taxes, and implicit costs, the spread, market impact, delay and missed fills, and the implicit ones are often larger.
- Second, the effective spread is twice the distance from the midpoint, and the V W A P cost compares your average price with the market's, with the sign reversed for a sale.
- Third, implementation shortfall measures from the decision price and adds execution, opportunity and fees.
- Fourth, markets went electronic for cost, rules and demand.
- Fifth, narrower quotes do not guarantee lower total cost for a large order.

30 Try three quick questions

1. Bid 15.40, ask 15.50. A seller gets 15.42. Effective spread?
   Answer: Mid 15.45; 2 × 0.03 = 0.06, inside the 0.10 quote.
2. Sold at an average 74.10; VWAP 74.40. Cost in basis points?
   Answer: (74.40 − 74.10) ÷ 74.40 = 40.3 bps, a cost.
3. Buy 8,000 at 20.00; fill 6,000 at 20.20; cancel rest at 20.60; fees 150. Shortfall?
   Answer: 1,200 + 1,200 + 150 = 2,550, which is 159.4 bps.

IN THE LESSON

- Now try three quick questions yourself.
- Question one.
- The bid is fifteen point four zero, the ask is fifteen point five zero, and a seller receives fifteen point four two.
- What is the effective spread?
- The midpoint is fifteen point four five, so twice point zero three gives point zero six.
- Question two.
- A manager sold at an average of seventy four point one zero while the V W A P was seventy four point four zero.
- What was the cost?
- The gap is point three zero, which is forty point three basis points, a cost.
- Question three.
- The manager decides to buy eight thousand shares at twenty, fills six thousand at twenty point two zero, cancels the rest at twenty point six zero, and pays one hundred and fifty in fees.
- What is the shortfall?
- Twelve hundred plus twelve hundred plus one hundred and fifty gives two thousand five hundred and fifty, which is one hundred and fifty nine point four basis points.
- Check your working against each answer.