Answers

31 TR Co

(a) **Step 1: Establish the demand function**

b = change in price/change in quantity
b = \$2/5,000 units = 0·0004

The maximum demand for Parapain is 1,000,000 units, so where P = 0, Q = 1,000,000, so 'a' is established by substituting these values for P and Q into the demand function:

0 = a – (0·0004 x 1,000,000)
0 = a – 400

Therefore a = 400

Demand function is therefore: P = 400 – 0·0004Q

Step 2: Establish the marginal cost

		Total $
Material Z	500 g x \$0·10	50
Material Y	300 g x \$0·50	150
Labour	Working 1	6·6039
Machine running cost	(20/60) x \$6·00	2
Total marginal cost per batch		208·6039

Note: Fixed overheads have been ignored as they are not part of the marginal cost.

The marginal cost will now be rounded down to \$208·60 per batch.

Working 1: Labour

The labour cost of the 1,000th unit needs to be calculated as follows as this is the basis TR Co will determine the price for Parapain:

Learning curve formula: $Y = aX^b$

'a' is the cost for the first batch: 5 hours x \$18 = \$90

If X = 1,000 batches and b = –0·321928, then
$Y = 90 \times 1{,}000^{-0{\cdot}321928} = 9{\cdot}7377411$
Total cost for 1,000 batches = \$9,737·7411

If X = 999 batches, then
$Y = 90 \times 999^{-0{\cdot}321928} = 9{\cdot}7408781$
Total cost for 999 batches = \$9,731·1372

Therefore the cost of the 1,000 batches (\$9,737·7411 – \$9,731·1372) = \$6·6039

Step 3: Establish the marginal revenue function: MR = a – 2bQ

Equate MC and MR and insert the values for 'a' and 'b' from the demand function in step 1.

208·60 = 400 – (2 x 0·0004 x Q)

Step 4: Solve the MR function to determine optimum quantity, Q

208·60 = 400 – 0·0008Q
0·0008Q = 191·4
Q = 239,250 batches

Step 5: Insert the value of Q from step 4 into the demand function determined in step 1 and calculate the optimum price

P = 400 – (0·0004 x 239,250)
P = \$304·30

Step 6: Calculate profit

	$
Revenue (239,250 batches x \$304·30)	72,803,775
Variable costs (239,250 batches x \$208·60)	(49,907,550)
Fixed costs (250,000 batches x \$2)	(500,000)
Profit	22,396,225

(b) **Market penetration pricing**

With penetration pricing, a low price would initially be charged for the anti-malaria drug. The ideology behind this is that the price will make the product accessible to a larger number of buyers and therefore the high sales will compensate for the lower prices being charged. The anti-malaria drug would rapidly become accepted as the only drug worth buying, i.e. it would gain rapid acceptance in the marketplace.

The circumstances which would favour a penetration pricing policy are:

– Highly elastic demand for the anti-malaria drug, i.e. the lower the price, the higher the demand. There is no evidence that this is the case.

– If significant economies of scale could be achieved by TR Co so that higher sales volumes would result in sizeable reductions in costs. It cannot be determined if this is the case here.

– If TR Co was actively trying to discourage new entrants into the market, however in this case, new entrants cannot enter the market anyway due to the patent.

– If TR Co wished to shorten the initial period of the drug's life-cycle so as to enter the growth and maturity stages quickly but there is no evidence the company wish to do this.

Market skimming pricing

With market skimming, high charges would initially be charged for the anti-malaria drug rather than low prices. This would enable TR Co to take advantage of the unique nature of the product. The most suitable conditions for this strategy are:

– The product has a short life cycle and high development costs which need to be recovered. There is no information about the drug's life cycle but development costs have been high.

– Since high prices attract competitors, there needs to be barriers to entry if competitors are to be deterred. In TR Co's case it has a patent for the drug and also the high development costs could act as a barrier.

– Where high prices in the early stages of a product's life cycle are expected to generate high initial cash flows, this will help TR Co recover the high development costs it has incurred.

Recommendation

Given the unique nature of the drug and the barriers to entry, a market skimming pricing strategy would appear to be the far more suitable pricing strategy. Also, whilst there is demand curve data, it is unknown how reliable this data is, in which case a skimming strategy may be the safer option.

32 Sports Co

(a) **(i)** Return on investment = controllable profit/average divisional net assets

Controllable profit

	C	E
	$'000	$'000
Net profit	1,455	3,950
Add back depreciation on non-controllable assets	49·5	138
Add back Head Office costs	620	700
Controllable profit	2,124·5	4,788

Average divisional net assets

	$'000	$'000
Opening assets	13,000	24,000
Closing assets	9,000	30,000
Average assets	11,000	27,000
ROI	19·3%	17·7%

(ii) Whilst Division C has exceeded the target ROI, Division E has not. If controllable profit in relation to revenue is considered, Division C's margin is 56% compared to Division E's margin of 57%, so Division E is actually performing slightly better. However, Division E has a larger asset base than Division C too, hence the fact that Division C has a higher ROI.

Since Division E appears to be a much larger division and is involved in sports equipment manufacturing, then it could be expected to have more assets. Division E's assets have gone up partly because it made substantial additions to plant and machinery. This means that as well as increasing the average assets figure, the additions will have been depreciated during the year, thus leading to lower profits. This may potentially have had a large impact on profits since Division E uses the reducing balance method of depreciation, meaning that more depreciation is charged in the early years.

Based on the ROI results, the manager of Division C will get a bonus and the manager of Division E will not. This will have a negative impact on the motivation level of the manager of Division E and may discourage him from making future investments, unless a change in the performance measure used is adopted.

(b) (i)

	C	E
	$'000	$'000
Controllable profit	2,124·5	4,788
Less: imputed charge on assets at 12%	(1,320)	(3,240)
Residual income	804·5	1,548

From the residual income results, it can clearly be seen that both divisions have performed well, with healthy RI figures of between $0·8m and $1·55m. The cost of capital of Sports Co is significantly lower than the target return on investment which the company seeks, making the residual income figure show a more positive position.

(ii) Advantages

The use of RI should encourage managers to make new investments, if the investment adds to the RI figure. A new investment can add to RI but reduce ROI and in such a situation measuring performance with RI would not result in the dysfunctional behaviour which has already been seen at Sports Co. Instead, RI will lead to decisions which are in the best interests of the company as a whole being made.

Since an imputed interest charge is deducted from profits when measuring the performance of the division, managers are made more aware of the cost of assets under their control. This is a benefit as it can discourage wasteful spending.

Alternative costs of capital can be applied to divisions and investments to account for different levels of risk. This can allow more informed decision-making.

Disadvantages

RI does not facilitate comparisons between divisions since the RI is driven by the size of divisions and their investments. This can clearly be seen in Sports Co where the RI of Division E is almost twice that of Division C, which will be related to Division E being a much larger division.

RI is also based on accounting measures of profit and capital employed which may be subject to manipulation so as, for example, to obtain a bonus payment. In this way it suffers from the same problems as ROI.

Section C				Maximum marks	Marks awarded
31	**(a)**		Demand function	1·5	
			Marginal cost/batch	2·5	
			Labour 1,000th batch	3·5	
			Establishing MR function	0·5	
			Solve MR to find Q	1	
			Use demand function and Q to find P	1	
			Contribution based on P and Q	1	
			Deduction of fixed costs	0·5	
			Profit	0·5	
				12	
	(b)		Penetration pricing	3	
			Skimming pricing	3	
			Other relevant comments/recommendation	2	
				8	
				20	
32	**(a)**	**(i)**	Net profit	1	
			Add back depreciation	1	
			Add back HO costs	1	
			Controllable profit	1	
			Average assets	1	
			ROI	1	
				6	
		(ii)	Discussion	**6**	
	(b)	**(i)**	Controllable profit	1	
			Imputed interest	1	
			RI	1	
			Comment	1	
				4	
		(ii)	Advantages/disadvantages	**4**	
				20	

F5 Examiner’s commentary on September/December 2017 sample questions

Question 31

This was a question mostly from the pricing area of the syllabus, although knowledge of learning curves was also tested. Part (a) required application of the MR=MC optimum price method, and part (b) required discussion of market skimming and penetration. Probably due to its technical nature, answers to part (a) were mixed, whereas candidates were generally able to score well in part (b).

Taking each requirement in turn:

(a) Calculate the optimum (profit-maximising) selling price for Parapain and the resulting annual profit which TR Co will make from charging this price.

It is important to read each requirement very carefully, to determine exactly what we need to do. Often, as is the case here, two (or more) things are asked for so it’s essential that you cover all requirements.

Firstly then, calculate the optimum selling price. There are two methods to find an optimum price in the syllabus, the tabular approach, and the MR=MC method.

The tabular approach is where we are given all possible prices and details of costs and volumes at each price. We then simply calculate the profit at each possible price to find the price with the highest profit. MR=MC is a method where we follow several algebraic steps to determine a theoretical optimum price. In questions of this type, the scenario will tell you which method to use. If you’re given possible prices and demands, then use the tabular method. If you’re given information about how changes in price will affect demand, it’s MR=MC.

There’s also a big clue in this question, the note in the requirement that if $P = a – bQ$, then $MR = a – 2bQ$. This is from the MR=MC method, so we should be using that. If you would like to see an example question using the tabular approach, see Question 1 on the March/June 2016 Sample Questions on the ACCA website.

The MR=MC method often scares students when they first see it, especially those who struggle with mathematics. However, the steps required are consistent, and practice is the key to getting over any initial confusion. To give a bit of background, the theory behind the model is that **profit is maximised when Marginal Cost = Marginal Revenue**, i.e. MC=MR. We are trying to find a profit maximising price, so we need to find the price where MC=MR. What are these things? Marginal cost is the cost of making one more unit of our product. If we make one more unit of our product, our costs will increase by the **variable cost per unit**, so this is the marginal cost (ignoring any complications like stepped fixed costs or variable cost/unit changing). Marginal revenue is slightly more complicated; by definition it is the revenue earned from selling one more unit. That might suggest that this is the selling price – sell one more unit and earn the selling price. However, in order to sell one more unit, you’d have to reduce the selling price, so it's more complicated than that. Fortunately, we don't need to worry about this complication, as the note mentioned above defines MR for us. This allows us to follow these steps to find where MC=MR, and therefore the optimum price:

1. **Find the demand equation P=a-bQ**

The demand equation shows how price, P and demand, Q are linked. The assumption (and therefore limitation) of this model is that price and demand have a (negative) linear relationship. This means that an increase in price will lead to a predictable decrease in demand, and vice versa. We can deal with the calculations later, but for now let's carry on with the steps.

2. **Find Marginal Revenue, MR**

This follows directly on from step 1, where we find a and b in P = a – bQ, so MR = a – 2bQ, as per the note.

3. **Find Marginal Cost, MC**

As already mentioned, this is the variable cost per unit.

4. **Profit is maximised when MC=MR**

As we know MC, and MR is a function of Q, we can solve this equation to find the profit-maximising demand.

5. **Find optimum P**

As we now know Q, we can find P using P = a – bQ.

This may still seem a bit of a mystery, and it's easier to explain with some numbers. However, knowledge of these steps makes it easier to find the required information from the scenario – firstly we know we need information on how changes in price affect demand to find the demand equation in step 1. Secondly, we need information on variable cost per unit.

The second paragraph of the scenario is key for this method. We are told that for a $2 decrease in price, demand would increase by 5,000 – i.e. information about how changes in price will affect demand. We are also told that maximum demand is one million.

We are then given important information about costs – two different materials, variable running costs and fixed costs. Finally, we are told that labour time per batch is subject to an 80% learning curve, and that all pricing decisions will be based on the time taken to produce the 1,000th unit. As this is a pricing decision, we must therefore use the time for the 1,000th unit.

The order you approach the various steps is up to you – many candidates calculated the learning curve aspects first, which is absolutely fine. For clarity though, this report will follow the steps in the order already given.

1. **Find the demand equation P = a – bQ**

We need to calculate 'a' and 'b' to find the demand equation. Going against alphabetical convention, it is usual to calculate b first. We are told that b = change in price/change in demand. From the scenario, a change in price of $2 will give a change in demand of 5,000. Therefore:

B = 2/5,000 = 0·0004 (or leave as a fraction)

a is defined as 'the price at which demand is zero'. This is less helpful, but now that we know b, our equation is starting to take form:

P = a – 0.0004Q

To calculate a, we just need an existing price and demand. If we put them into the equation, we can find a. Previous questions have given information like 'the current price is $150 and demand is 40,000 (say), which is what you would use to calculate a. This one is slightly different – we are told that **maximum demand is 1 million**. Maximum demand would be achieved at a price of 0, so that is the price/demand combination we would use:

0 = a – (0·0004 x 1,000,000)
0 = a – 400
a = 400

Virtually all candidates were able to calculate b, but many struggled with a. The best advice I can give here is **don't give up**! As this is the first step, there are still many marks to come – even if you calculate a incorrectly, if your method following that is correct, you will still pick up most of the marks. This is where the Section C questions differ from A and B – you may not get the answer 100% correct but will still pick up marks for correct technique – you could even put a note saying 'I assume a is 100,' for example.

Anyway, we now know that P = 400 – 0.0004Q. So for any given demand, we can calculate the price required.

2. **Find Marginal Revenue, MR**

You can write this straight down: MR = 400 – 0.0008Q, doubling the value of b.

3. Find Marginal Cost, MC

Reading the scenario, we can identify the variable costs:

Item	Working	$
Material Z	500 x $0·10	50
Material Y	300 x $0·50	150
Machine time	(20/60) x $6/hr	2
Labour	Time of 1,000th batch x $18/hr	?
Total		?

The labour cost will require further work, as discussed we need to know that we need the cost of batch 1000. This is a commonly used method, and was well attempted, so just to show the workings:

	1,000 batches	999 batches
Average time/batch y = ax^b	5*1,000^0·321928 = **0·54099**	5*999^0·321928 = **0·5412**
Total time for all batches	0·54099*1,000 = **540·9860**	0·5412*999 = **540·6191**
Time for 1,000th batch (difference)	540·9860 – 540·6191 = **0.3669hours**	

One small point to note here; when calculating y, the average time per batch using the learning curve formula, you then need to multiply this by the number of batches. It is important not to round this number too early, as it can make a big difference to your final answer. Simply take the number in your calculator and multiply it by the number of batches without clearing the value to avoid this.

We can now complete our MC working:

Item	Working	$
Material Z	500 x $0·10	50
Material Y	300 x $0·50	150
Machine time	(20/60) x $6/hr	2
Labour	0·3669 x $18/hr	6·60
Total		208·60

Note that writing out all of the variable costs in this way makes it easier to follow the answer – we got to the point where I didn't know one of the values (labour cost), but calculated this separately and then filled in the final value.

4. **Profit is maximised when MC=MR**

Now we have everything we need:
Substituting in what we know MR=MC:

208·60 = 400 – 0·0008Q – this gives us an equation with one unknown, Q – so rearrange
208·60 – 400 = –0·0008Q – subtract 400 from both sides
–194·4 = –0·0008Q
–194·4/–0·0008 = Q – divide through by –0·0008
Q = 239,250

What this tells us is that a demand of 239,250 will maximise our profit – nearly there!

5. **Find optimum P**

We know from step 1 that P = 400 – 0.0004Q, and Q = 239,250, so:

P = 400 – (0.0004 x 239,250)
P = 304·3

Our profit maximising price is $304.30

After all of this work, you might be tempted to think you've finished and move on BUT it's always a good idea to double check the requirement. We were asked to find the profit maximising price AND the resulting annual profit. This is actually the most straightforward part of the question. Usually the quickest way to get to profit is total contribution – fixed costs, and we have all of that information:

Contribution/unit	Selling price – VC/unit	304·3 – 208·6	95·7
Total contribution	Contribution/unit x demand	95·7 x 239,350	22,905,795
Fixed cost	FC/unit x budgeted demand	2 x 250,000	(500,000)
Profit	Contribution-fixed cost		22,405,795

It is worth persevering this far to pick up these easy marks. Having said that, the most common error was to multiply the fixed cost per unit of $2 by the new demand. Remember, fixed costs are fixed, so don't change with demand. If we budgeted for $500,000 fixed costs at a demand of 250,000 units, we'd budget for $500,000 at a demand of 239,350.

On to part (b)

(b) Discuss and recommend whether market penetration or market skimming would be the most suitable pricing strategy for TR Co when launching the new anti-malaria drug.

The verbs used in the requirements are particularly important for written questions such as this. Here, we are asked to **discuss** and **recommend**. Discuss implies some depth – advantages and disadvantages are often a good start. We're asked to discuss their suitability for pricing the drug, so need to look at whether they should/shouldn't be used. It's also important that we **recommend** which one to use, based on our discussion.

This requirement was well answered, and the model answer goes into lots of detail about the suitability or otherwise of each method, so I won't add more to that. Reading through it, or looking at the scenario, you can see that virtually all of the arguments are in favour of market skimming. It is worth mentioning from an exam technique point of view that many candidates spotted this – recommending skimming and talking in depth about why it was suitable. Unfortunately they didn't mention penetration at all, which meant that their answer could not be given full credit. It's important to discuss all aspects of the requirement to gain full credit. Use of headings to structure your answer will help avoid this problem – on reading that requirement you can immediately split it into 3 headings – **Penetration, Skimming** and **Recommendation**. Ensure that you cover all 3 to maximise your marks.

Question 32

Sports Co was a typical divisional performance measurement question, asking candidates to calculate return on investment (ROI) and residual income (RI), as well as some discursive aspects.

The calculations were performed well – virtually all candidates were able to calculate ROI and RI. However, marks were still a little varied as only stronger candidates were able to make the necessary adjustments to profit to allow for controllability. In questions of this type, it's especially important to look in the scenario for clues about anything which the divisional managers can't control. Here, we're specifically told in the notes that a proportion of the depreciation costs are not controlled by the divisional managers, and that head office recharges are included in fixed costs. These will not be controllable, so should be added back to profit.

Once controllable profit and average net assets have been calculated for (a), the same figures should be used in the calculation of RI in (b), making (b)(i) a relatively straightforward question, and candidates scored well accordingly.

Performance in the discursive aspects was less strong. Looking at the requirement for (a)(ii) in detail, we're asked to discuss the two divisions' performance, including the ROI difference. However, there is a second part – to explain the impact this ROI difference could have on the manager of the worst performing division.

Again, from an exam technique point of view it's easy to get bogged down in the detail of the performance management part, and forget about the second part. With a fairly open requirement like 'discuss the performance,' candidates can often spend too long looking at irrelevant or unnecessary comparisons. This is where reading the scenario carefully is so useful.

To score well in a performance assessment question, you need to add value to your discussion, rather than bland comments like 'E did better than C.' Some key points from the scenario:

- Divisional managers make decisions about investments
- Target ROI is 18%
- Bonus awarded for meeting this
- Division E made $2m investment

There are other points, but this is only a 6 mark question, so let's not get carried away. Looking at those, we can easily look at our calculations and comment:

- Did managers meet target?
- Will they get a bonus?
- Large investment will increase net assets so reduce ROI

Other points such as the difference between the businesses can also be used to explain the different ROIs, but don't forget to discuss the behavioural aspects – the manager will be demotivated, and may try to manipulate the figures by not investing. These are textbook points, but can be applied to this scenario.

Finally, (b)(ii) looks like a simple advantages/disadvantages of RI question. However, scores on this were fairly low – the main reason because candidates did not address the **Explain** part of the requirement. Many candidates simply **stated** several advantages/disadvantages of RI, without explaining them. For example, one common advantage given was 'RI reduces dysfunctional decision making.' This does not explain the advantage – a 'because' comes in handy here. 'RI reduces dysfunctional decision making because it uses the whole company's cost of capital, so positive RI projects for the company would also be accepted by the division.' That extra couple of seconds making sure that you have addressed the requirement properly will pay dividends.