



ACCA

Paper P4

Advanced Financial Management
June 2012

Final Assessment – Answers



To gain maximum benefit, do not refer to these answers until you have completed the final assessment questions and submitted them for marking.

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ANSWER 1**(a) Valuations for BV**

Three possible methods of valuation that could be used to value the shares of BV are:

- net assets basis
- dividend basis
- earnings basis.

Net assets attributable to equity of BV = £45m

Number of shares in issue = 1.5m

∴ Net asset value per share = £30

Usually, the net assets value method of valuing a company is not very useful since a conventional balance sheet is drawn up using costs (not market values) and excludes many valuable assets (e.g. trained employees, business know-how, etc). However in the case of BV we have a company with a number of owned car showrooms and a valuable franchise. If the showrooms are measured on the balance sheet at their open market value, and if the franchise is included on the balance sheet at cost or fair value, then it is possible that the company's net asset value will be relevant to LM.

The **dividend valuation model** states that:

$$\begin{aligned} \text{Company value} &= \frac{\text{Next year's dividend total}}{\text{Cost of equity} - \text{Annual growthrate}} \\ &= \frac{1.5\text{m} \times \text{£}1 \times 1.05}{0.1 - 0.05} \\ &= \text{£}31.5\text{m} \end{aligned}$$

There are a number of points that should be made concerning this valuation:

- We have assumed that next year's dividend will be this year's dividend (£1 per share) increased by the general forecast growth rate. However, given that earnings are expected to almost double next year (from $1.5\text{m} \times \text{£}1.53 = \text{£}2.3\text{m}$, up to £4m), this estimate of next year's dividend may be too modest.
- We have assumed a cost of equity of 10%, since this is the industry average for similar companies. Clearly we need to assess whether BV is anything like an 'average' company before we can use this figure.
- We have assumed that dividends will grow each year in the future at an annual rate equal to the 5% forecast growth rate for the company as a whole. Dividend policy is a matter for the directors of the company to decide, but in the long run this 5% rate may be reasonable. If LM acquires the company, it will be able to control the dividend policy directly.

The **earnings valuation** for a company is given by:

$$\begin{aligned} \text{Company value} &= \text{Earnings} \times \text{Appropriate P/E ratio} \\ &= \text{£}4\text{m} \times \frac{1,237}{112.5} = \text{£}44\text{m} \end{aligned}$$

In this valuation, next year's earnings (as forecast by the Managing Director of BV) have been used. The MD has an interest in being optimistic and overstating the forecast earnings figure. The alternative would be to use this year's earnings figure of $1.5\text{m} \times \text{£}1.53 = \text{£}2.3\text{m}$, which would produce a much lower valuation.

There is no P/E ratio for BV, since it is a private company.

We have used the only P/E ratio provided in the question, that for LM.

$$\text{P/E ratio} = \frac{\text{Share price}}{\text{EPS}} = \frac{1,237\text{p}}{112.5\text{p}} = 11$$

It would be possible to adjust this P/E ratio arbitrarily either up or down to reflect the different characteristics of LM (a large public company with plenty of land and property) and BV (a smaller private company with good growth prospects), but since this adjustment could be either up or down, the simple decision has been taken to leave it unchanged.

Conclusion

The following valuations for BV have been produced:

	£m
Net assets basis	45
Dividend valuation model	31.5
Earnings basis (using current earnings)	$\text{£}2.3 \times 11 = 25.3$
Earnings basis (using forecast earnings)	$\text{£}4.0 \times 11 = 44.0$

LM should be prepared to negotiate within the range of £40m to, say, £48m. There seems little prospect of the shareholders of BV selling for less than the £45m net asset value, but perhaps some assets are overstated in the balance sheet.

(b) Financial factors affecting the bid

It is unusual for the net assets basis of valuing a company to exceed the dividend basis and the earnings basis. There are many estimates used in the latter two bases, so perhaps they are inaccurate in this example. As stated in part (i), it would be unlikely that the shareholders of BV would agree to sell their shares for less than the net assets basis, so in this example we can forget the dividend basis and the earnings basis.

It is the Managing Director of BV who has approached LM, so the balance of power is such that LM can decide at its leisure whether to bid. LM has a market capitalisation of $25\text{m} \times \text{£}12.37 = \text{£}309.25\text{m}$. It is being asked to bid for a much smaller company, worth around £45m, in wealthy locations in the north of England. LM appears to be a volume player in the motor car market, with no apparent experience of semi-rural showrooms. Given LM's lack of experience, perhaps it should not bother to bid for this much smaller company, or certainly it should not pay an excessive premium over net asset value.

Curiously, we see that LM's net asset value (£350m) also exceeds its market valuation (£309.25m). It is possible that the motor car business is unfavourably valued by the market. It is also possible that the market has overlooked the high asset backing to LM's shares. It is possible that, if it launches a bid for BV and becomes better known in the market as a result of the accompanying publicity, then LM itself could become a target for takeover bids.

What other investment opportunities are available for the £45m (or so) expected to be invested in the acquisition?

Do all the BV shareholders want to sell their shares, or will there be a significant minority interest that will want to hold on? LM might not want to acquire a company if less than 100% of the shares can be acquired.

(c) **The form of funding the bid**

We are looking to finance an acquisition costing in the region of £45m, and must decide whether to offer shares or cash as the consideration. The Managing Director of BV has indicated that holders of up to 50% of BV's shares might accept shares.

LM's current debt ratio is 20%, thus:

$$\frac{\text{LM's debt}}{\text{LM's debt} + \text{£309.25m}} = 0.2$$

$$\therefore \text{LM's current debt} = \frac{\text{£61.85}}{0.8} = \text{£77.3m}$$

The most new gearing possible would be if all the BV shareholders were paid in cash, raised from new borrowings. Thus £45m of fresh debt would be issued.

$$\text{LM's new debt ratio} = \frac{77.3 + 45}{77.3 + 45 + 309.25} = 28\%$$

This does not seem excessive for a large company such as LM, especially considering the excellent asset backing available to secure issues of debt.

On the other hand, a new equity issue would reduce the debt ratio, but this is not a pressing priority. In practice, some combination of shares and cash is likely to be negotiated, depending on the requirements and tax positions of individual BV shareholders.

(d) **Features of growth by acquisition versus organic growth**

The advantages of growth by acquisition are:

- much quicker method of increasing market share than growing organically
- since the two companies will not have perfectly correlated cash flows, combining them together will offer diversification opportunity and a reduction in the cost of capital. This should increase the value of the group and therefore increase shareholder wealth
- buying out one's competitors reduces the competition faced in the market, thereby strengthening one's price-setting ability.

The disadvantages of growth by acquisition are:

- it is usually more expensive for the purchasing company. Research continually shows that in contested acquisitions it is the shareholders of the target company who gain the greatest share of the benefits arising
- many acquisitions are planned in anticipation of generating synergistic cost savings, but in practice these synergies often fail to appear after the acquisition
- there may be cultural clashes following the acquisition between the two sets of employees. If the skilled employees of the acquiree become demotivated and leave, then much of the skill set that was paid for in the acquisition has been lost.

ACCA marking scheme				Marks
(a)	Asset based valuation	–	calculation	1
		–	comment	1
	Dividend valuation	–	calculation	2
		–	comment	3
	Earnings valuation	–	calculation	2
		–	comment	3
	Recommendations	–	range for negotiation	2
				Max 14
(b)	One mark per valid point			Max 6
(c)	One mark per valid point			Max 6
(d)	One mark per valid point			Max 6
				—
Total				30
				—

ANSWER 2

(a) **Tutorial note:** The table of payments and receipts might be difficult to understand on first reading it. It shows, for example, that the UK division will (in 000s) pay £100 to the Spain division and receive €210 from Spain in the same period. Similarly, Spain will pay €210 to the UK and €120 to the USA, and receive €80 from Hong Kong.

(i) Receipts and payments in sterling at spot mid-rates:

Payments (read down)	£000				
Receipts (read across)	UK	Spain	Hong Kong	USA	Total receipts
UK	–	128.96	64.27	76.59	269.82
Spain	100.00	–	49.13	–	149.13
Hong Kong	35.71	–	–	–	35.71
USA	<u>299.40</u>	<u>73.69</u>	<u>26.78</u>	–	<u>399.87</u>
Total payments	(435.11)	(202.65)	(140.18)	(76.59)	854.53
Net	(165.29)	(53.52)	(104.47)	323.28	

Tutorial notes:

(1) Spot mid rates are US\$1.4362/£1, €1.62835/£1 and HK\$11.20185/£1.

(2) The receipts minus payments figures are calculated simply by subtracting the payments total for each currency from the receipts total shown in the right-hand column of the table.

As a result of multilateral netting the number of transactions may be reduced from nine to three, with the UK parent, the Spanish and Hong Kong subsidiaries each making one payment to the US subsidiary.

(ii) Forward contracts, money market hedging and currency options will be illustrated.

In order to minimise transaction costs, netting of trade will be used where possible. As the Hong Kong dollar is pegged against the US dollar, the exposure risk of the Hong Kong dollar will be hedged using US dollars.

This involves a slight risk, as the Hong Kong dollar might discontinue its pegged position. As interest rates are less than 1% different between the USA and Hong Kong, the economic pressure for the Hong Kong dollar to devalue is not likely to be strong at present.

UK parent net exposures (in 000s):

<i>Payments</i>	<i>Receipts</i>	<i>Net for hedging, () is payment</i>
£100	–	n.a.
–	€210	€210
HK\$400	HK\$720	\$HK320 = \$US41.03 (at cross rate of \$HK7.800/\$US)
US\$430	US\$110	(US\$320). So net = (US\$320) – US\$41.03 = (US\$278.97)

Only two exposures need to be hedged; receipts of €210,000 and payments of US\$278,970.

Forward markets:

$$\text{Euro} \quad \frac{\text{€}210,000}{1.6166} = \text{£}129,902 \text{ receipt}$$

$$\text{US\$} \quad \frac{\text{\$}278,970}{1.4285} = \text{£}195,289 \text{ payment}$$

Money markets:

Euro hedge:

Borrow Euro at 5.3% for three months:

$$\frac{\text{€}210,000}{1.01325} \text{ or } 207,254 \text{ to repay Euro } 210,000 \text{ in three months' time.}$$

Convert Euro 207,254 at spot of £1.6292/€ to give £127,212.

Invest £127,212 for three months at 6.0% to yield £127,212 × 1.015 = £129,120.

US dollar hedge:

Borrow £191,708 at 6.9% for three months, total cost £195,015.

Convert £191,708 to dollars at the spot of \$1.4358/£ to give \$275,254.

Invest \$275,254 for three months at 5.4% to yield \$278,970.

Options:

September put options on £ are required as a payment in US dollars is due.

Exercise price 1.42:

$$\text{Number of contracts} \quad \frac{\text{\$}278,970}{1.42} = \text{£}196,458, \quad \frac{\text{£}196,458}{\text{£}31,250} = 6.29 \text{ contracts}$$

£31,250 × 6 × 1.42 = \$266,250 is hedged, the remaining \$12,720 will be bought forward at \$1.4285/£ or a cost of £8,904.

Exercise price 1.43:

$$\text{Number of contracts} \frac{\$278,970}{1.43} = \text{£}195,084, \quad \frac{\text{£}195,084}{\text{£}31,250} = 6.24 \text{ contracts}$$

£31,250 × 6 × 1.43 = \$268,125 is hedged, the remaining \$10,845 will be bought forward at \$1.4285/£ or a cost of £7,592.

Exercise price 1.44:

$$\text{Number of contracts} \frac{\$278,970}{1.44} = \text{£}193,729, \quad \frac{\text{£}193,729}{\text{£}31,250} = 6.20 \text{ contracts}$$

£31,250 × 6 × 1.44 = \$270,000 is hedged, the remaining \$8,970 will be bought forward at \$1.4285/£ or a cost of £6,279.

Premium costs (including three months financing at 6.9% per annum)**Exercise price:**

$$1.42 \quad \text{£}187,500 \times 2.15c = \$4,031 @ \$1.4358/\text{£} = \text{£}2,808 \times 1.01725 = \text{£}2,856$$

$$1.43 \quad \text{£}187,500 \times 3.12c = \$5,850 @ \$1.4358/\text{£} = \text{£}4,074 \times 1.01725 = \text{£}4,145$$

$$1.44 \quad \text{£}187,500 \times 4.35c = \$8,156 @ \$1.4358/\text{£} = \text{£}5,680 \times 1.01725 = \text{£}5,778$$

Total cost if the option is exercised:

$$1.42 \quad \text{£}187,500 + \text{£}2,856 + \text{£}8,904 = \text{£}199,260$$

$$1.43 \quad \text{£}187,500 + \text{£}4,145 + \text{£}7,592 = \text{£}199,237$$

$$1.44 \quad \text{£}187,500 + \text{£}5,778 + \text{£}6,279 = \text{£}199,557$$

Note: If the option is sold to include time value, rather than exercised, these costs would be slightly reduced.

In order for the option to be preferred to the best alternative, the money market hedge which has a cost of £195,015, the total cost of using the option must be less than the cost of the money market hedge. The necessary costs of the option component of the hedge are estimated below, along with the spot rates that would produce this result.

	Money market	– (Forward	+ Premium)	= Required option cost	Spot rate
1.42	£195,015	£8,904	£2,856	£183,255	266,250/183,255
1.43	£195,015	£7,592	£4,145	£183,278	268,125/183,278
1.44	£195,015	£6,279	£5,778	£182,958	270,000/182,958

The required spot rates for the option to be the preferred hedge are rates where the dollar is weaker than:

$$1.42 \quad \$1.4529/\text{£}$$

$$1.43 \quad \$1.4629/\text{£}$$

$$1.44 \quad \$1.4757/\text{£}$$

Conclusion:

A forward market hedge is recommended for the euro transaction.

For the \$US payment a money market hedge or, alternatively, a currency option hedge with an exercise price of 1.42 is recommended. The 1.42 exercise price is chosen as this has a similar cost to the 1.43 option if it is exercised, but requires the dollar to depreciate less before the option hedge is the preferred alternative to the money market hedge.

- (b) As the Russian currency is not convertible, if NTC wishes to export to Russia, payment through countertrade may be the only way in which the deal may be arranged. There may also be restrictions in Russia in the use of convertible foreign currency reserves for the purchase of imports, and limited access to bank credits. Without countertrade there may be no trade in these circumstances.

Problems of countertrade include:

- (i) It requires considerable time and effort to organise, and often has high administrative costs.
- (ii) It may be difficult and expensive to establish a fair exchange ratio for goods to be countertraded.
- (iii) The price for wheat that NTC will receive may be unknown, although a futures market exists in wheat.
- (iv) The quality of the wheat is not known with certainty.
- (v) One party has to bear transportation costs of the wheat.
- (vi) Bank guarantees and other forms of security that exist in foreign trade through documentary letters of credit, bills of exchange, etc are unlikely to exist, possibly increasing the risk of trade for NTC.

Advantages of countertrade include:

- (i) Allowing NTC to become known in the Russian market, which may generate future business.
- (ii) Eliminating the risks concerned with foreign exchange rate movements.

Tutorial note:

Countertrade involves the sale of goods (or services) to a customer in another country, usually a country whose currency is not freely convertible, and the receipt of payment from the customer in other goods rather than money. These goods are then sold on to another customer or distributor in a country with a freely convertible currency. For example, a Swiss exporter of optical equipment to a South American country might agree to take payment in other goods, say coffee beans, which could then be sold in the European markets for cash.

ACCA marking scheme			<i>Marks</i>
(a)	(i)	Spot mid rates	2
		Completion of table, up to	6
		Conclusion	1
	(ii)	Calculation of \$HK to \$UK rate	2
		Forward contracts	2
		Money market hedge € only	3
		Put options \$ only	5
		Conclusion if consistent	1
		Discussion points	1
		Presentation	1
(b)	1 mark for each well explained point	Max 6	
Total			30

ANSWER 3**Futures hedge:**

Set up the current position: $€4m \times .05 \times 6/12 = €100,000$

Set up the hedge:

- (a) Buy or sell: Deposit → Buy futures contracts.
 (b) Number of contracts: $\frac{€4m}{€1m} \times \frac{6 \text{ months}}{3 \text{ months}} = 8 \text{ contracts.}$
 (c) State the hedge: Buy 8 € March future contracts at a price of 93.20.

The play off:

	<i>Now</i>	<i>Rate agreed</i>	<i>Profit and loss</i>
Company rates	5.0%	4.0%	(1.0%)
Futures prices	93.20	94.05	0.85%
	Buy	Sell	(0.15%)

Profit on futures:

Profit = 85 ticks $\times €25.00 \times 8 \text{ contracts} = €17,000$

The cash flows:

Actual interest payable/receivable $€4m \times .04 \times 6/12 = €80,000$

Profit on futures $€17,000$

The cash result

€97,000

The play off:

	<i>Now</i>	<i>Rate agreed</i>	<i>Profit and loss</i>
Company rates	5.0%	7.0%	2.0%
Futures prices	93.20	91.30	(1.90%)
	Buy	Sell	0.10%

Loss on futures:

Loss = 190 ticks $\times €25.00 \times 8 \text{ contracts} = (€38,000)$

The cash flows:

Actual interest payable/receivable $€4m \times .07 \times 6/12 = €140,000$

Profit on futures $(€38,000)$

The cash result

(€102,000)

Options hedge

Set up hedge:

- (a) Calls or Puts: Deposit → Buy futures contracts → Buy calls
- (b) Choosing the exercise price: *Call options – Deposit – Highest net receipt*

<i>Exercise price</i>	<i>Implied interest rate</i>	<i>Cost of premium</i>	<i>Net receipt</i>
92.50	7.50%	(0.90%)	6.60%
93.00	7.00%	(0.54%)	6.46%
93.50	6.50%	(0.24%)	6.26%

- (c) Options on futures: Therefore 8 contracts as previously calculated.
- (d) State the hedge: Buy 8 € March call contracts at an exercise price of 92.50.

Cost of the option:

90 ticks × **€25.00** × 8 contracts = €18,000

Decision point:

	<i>Adverse movement Exercise to protect</i>	<i>Favourable movement Allow the option lapse</i>
Actual interest paid (note calculated already in futures part)	80,000	140,000
Cost of the options	(18,000)	(18,000)
Profit on futures		
Sell – 94.05		
Buy – (92.50)		
1.55		
155 ticks × 25.00 × 8 contracts =	31,000	–
Total payment	93,000	122,000

Summary table approach:

The target in this question that interest receipts do not decrease by more than €2,500 from current rates. I have prepared a summary table to see if the specified target of €97,500 (i.e. €100,000 – €2,500) is achieved.

Summary table

	<i>Futures</i>	<i>Options</i>	<i>Not hedged</i>
1% fall	97,000	93,000	80,000
2% increase	102,000	122,000	140,000

Conclusions

Neither futures nor options hedges can guarantee that the interest receipts should be more than €97,500.

The company should hedge, if it did not it could end up receiving only €80,000.

It should hedge using futures as they give the highest receipt under both scenarios.

The collar comment:

In any option question always state that the company should consider the use of a collar. The collar is used to reduce the premium cost of the purchased option. The company would buy a call option (sets a minimum income) as normal but also sell puts options (sets the maximum income) on the same futures contract. Thus, the company is paid for limiting its ability to take advantage of a favourable movement if the interest rate increases above the maximum rate the company does not benefit.

ACCA marking scheme		<i>Marks</i>
Futures		
Buy March futures		2
Number of contracts		1
Hedge adverse movement, with outcome		2
Hedge favourable movement, with outcome		2
Options		
Buy 8 March call contracts		3
Cost of options		2
Cash flows: when adverse movement		3
when favourable movement		1
Summary table		1
Collar comment		3
Total		20

ANSWER 4

- (a) A strategy of diversification does not always provide a sound rationale for a takeover.

One problem is that the synergies identified are often more difficult to achieve when two businesses, which are quite different in nature, are combined. Such differences may, for example, prevent Emlyn Co from benefiting from economies of scale or the use of complementary resources. Similarly, although the management team of Emlyn Co may be highly efficient and highly motivated, it may not have the necessary skills to replace the management team of the victim company.

There may also be problems in trying to integrate the operations of two different kinds of business because of differences in market needs, business culture and so on.

Diversification is a useful way of dealing with risk and it is therefore intuitively appealing to see mergers and takeovers as a useful means to achieve this end. The question that must be asked however is whether the directors of the company should diversify or whether the shareholders should diversify. It is usually easier and cheaper for shareholders to diversify, by acquiring a diversified portfolio of shares, than for the directors to diversify.

When the directors of a company diversify, by taking over another company, a significant premium is often paid to the shareholders of the target company.

- (b) In theory, shareholder wealth will increase if the NPV of the company's cashflows increases. In order for this to happen, there needs to be an increase in cashflows and /or a reduction in the cost of capital following the acquisition.

There are various practical ways in which a gain may be achieved through a takeover. These include:

Eliminating competition

A business can take over another in order to eliminate market competition. By increasing market share, the combined business may be in a better position to influence prices and, in turn, profits. However, this can have an adverse effect on the consumer and so the government may intervene when mergers and acquisitions that have a significant effect on market share are being proposed.

Complementary resources

A business may decide to acquire another in order to gain access to resources or particular strengths that it lacks. For example, a business with a strong manufacturing base but with poorly-designed products may wish to acquire another business that has a strong manufacturing-design base. By combining the relative strengths of the two businesses, additional profits may be generated.

Benefits of scale

Acquiring another business will result in the creation of a larger business. This in turn, can lead to economies of scale. These economies may be gained through exerting market power (e.g. negotiating lower prices by purchasing in bulk) or by cost savings (e.g. avoiding costs where duplication occurs).

Underutilised resources

In some cases, the resources of a business may be underutilised. This may be due to a weak management team that has failed to exploit the full potential of the business. By taking over the business and installing a new management team, the resources of the business may be more fully utilised leading to additional profits being made.

(Examiner's note. Other answers to this part, such as market imperfections leading to undervalued shares in the target company, would have been acceptable.)

- (c) There are various reasons why a takeover may not yield the expected benefits to the shareholders in the bidding company. These include:

Paying too much for the target company.

The management of the bidding company may pay too much for the target company. It is quite common for a premium to be paid to the shareholders of the target company in order to encourage them to sell their shares. Unless there are benefits accruing from the takeover, this premium paid will simply transfer wealth from the shareholders of the bidding company to the shareholders in the target company.

Hidden problems

Problems that were hidden at the time of the takeover may emerge later to eliminate any gains that were anticipated. These problems may have been deeply buried and so may have been difficult to unearth, even where proper due diligence procedures were carried out prior to a takeover agreement.

Integration issues

Integrating the two businesses following takeover may prove a difficult task. There may be differences in culture, management style, and organisational methods and systems that cannot be easily reconciled. Integration problems are most acute where there is an attempt to impose a common style and common systems following takeover. Where the former target company is allowed to maintain its own identity and its own systems, integration problems are likely to be much less of an issue.

Management attitudes and motivation

Once the takeover has been completed, managers may expect the enlarged business to achieve success without the need for much effort. They may feel that the takeover was the most important ingredient for success and expect that future operations will run smoothly. In some cases, an exhausting takeover struggle may leave managers with little energy or enthusiasm for ensuring that things go according to plan.

- (d) Financial analysts play a key role in ensuring stock markets are efficient.

They provide information about listed companies to investors, which should help in ensuring that share prices reflect their ‘true value’.

In addition to disseminating information to others, they are constantly examining share prices in the hope of finding shares that are inefficiently priced. Where the price of a share in a listed company is below its ‘true value’, there is an incentive to buy the shares, assuming that the ‘true value’ will eventually be recognised by the market.

The effect of buying the shares will be to eliminate the price inefficiency and so bring the share price into line with the ‘true value’.

It is often claimed that an efficient market reflects a paradox. The search for inefficiently priced shares by financial analysts, investment managers and others is based on a belief that the market is inefficient. This search, however, eliminates any price inefficiencies that may exist and thereby helps to create an efficient market.

ACCA marking scheme	
<p>(a) Diversification – generally 1 mark per sensible point key points are</p> <ul style="list-style-type: none"> – should the company bother to diversify when investors can do so for themselves? – will any identified synergies actually be realised? 	<p><i>Marks</i> Max 5</p> <p>_____</p> <p>Max 5</p> <p>_____</p>
<p>(b) Increase in wealth Theory – link to NPV Up to 1½ marks per key practical point if well explained</p>	<p>1 Max 4</p> <p>_____</p> <p>Max 5</p> <p>_____</p>
<p>(c) Up to 1½ marks per key practical point if well explained</p>	<p>Max 5</p>
<p>(d) One mark per valid, well explained point</p>	<p>Max 5</p> <p>_____</p>
Total	<p>20</p> <p>_____</p>

ANSWER 5

(a) **Step 1: Calculate d_1 and d_2**

$$d_1 = \frac{\ln(P_a/P_e) + (r+0.5s^2)t}{s\sqrt{t}}$$

$$d_1 = \frac{\ln(1.80/1.50) + (0.1+0.5^2)0.25}{0.5 \times \sqrt{0.25}}$$

$$d_1 = \frac{0.1823 + 0.0563}{0.25}$$

$$d_1 = 0.95$$

$$d_2 = d_1 - \sigma\sqrt{T}$$

$$= 0.95 - 0.5 \times \sqrt{0.25}$$

$$= 0.70$$

Step 2: Use normal distribution tables to find the value of $N(d_1)$ and $N(d_2)$

$$N(d_1) = 0.5 + 0.3289 = 0.8289$$

$$N(d_2) = 0.5 + 0.2580 = 0.7580$$

Step 3: Plug these numbers into the Black- Scholes formula

$$\text{Value of a call option} = [\text{Delta} \times \text{Share price}] - [\text{Bank loan}]$$

$$= P_a N(d_1) - P_e e^{-rT} N(d_2)$$

$$= 1.80 \times 0.8289 - 1.50e^{-(0.1 \times 0.25)} 0.7580$$

$$= 1.4920 - 1.4630 \times 0.7580$$

$$= 0.3830 = \text{Intrinsic value and Time value}$$

(Reasonableness check: this exceeds the intrinsic value of 0.3 so it looks ok.)

A call option on 4,000 Lambley shares would be quoted at $4,000 \times \text{£}0.3830 = \text{£}1,532$.

(b) Client B purchased 10,000 shares and which to hedge the position, how many call options would he have to sell to construct a risk free investment?

$$0.8289 = \frac{10,000}{\text{Number of calls sold}} = \text{Sell } 12,064 \text{ call options}$$

(c) **Using put call parity to value a put option**

$\text{£}0.3803$		$\text{£}1.80$
Value of a call option		Buy a share
+	=	+
Invest the PV		Value of a put option
of the exercise price		
$1.50e^{-(0.1 \times 0.25)}$		

= £0.3830 + £1.4630 – £1.80 = Value of a put

= **£0.0460**

= 2,000 puts would therefore cost

= 2,000 × 0.046 = £92

(Reasonableness check: this option is out of the money so we would expect a low value.)

(d) The same basic principles apply to the value of a currency option as to an equity option. Imagine we wanted an option to buy sterling with US dollars (a call option on £). The value of the call option would depend upon:

- 1 The spot exchange rate. The higher the spot price of sterling (\$ per £) the more valuable the option to buy it at a fixed price will be.
- 2 The exercise price. The lower the exercise price (\$ per £) the more valuable the option.
- 3 The time to expiry. The longer the time period to expiry the more chance there is of the price of sterling rising (\$ per £).
- 4 The volatility of the exchange rate. The more volatile the exchange rate the more chance there is of sterling rising.
- 5 The counter currency (\$) interest rate. As above the present value of the \$ exercise price will fall as \$ interest rates rise. As \$ interest rates rise the option becomes more valuable.
- 6 The underlying currency (£) interest rate. The purchaser of a sterling option is paying the issuer a \$ amount (the premium) for an option that can be exercised to buy a given amount of £. The purchaser is giving up £ interest that could have been earned on the premium

These factors are incorporated within the Grabbe variant of the Black-Scholes formula.

This enables the financial manager to work out the value of a currency call (or put) option.

ACCA marking scheme	
	<i>Marks</i>
(a) Value of call options – reward technique	7
(b) Delta hedge	2
(c) Value of a put option	4
(d) One mark per valid determinant	7

Total	Max 20
