Strategic Professional – Options

Advanced Financial Management (AFM)

March/June 2019 – Sample Questions

AFM ACCA

Time allowed: 3 hours 15 minutes

This question paper is divided into two sections:

Section A – This ONE question is compulsory and MUST be attempted

Section B – BOTH questions are compulsory and MUST be attempted

Formulae and tables are on pages 8–12.

Do NOT open this question paper until instructed by the supervisor.

This question paper must not be removed from the examination hall.

AFM

Think Ahead

ACCA

The Association of Chartered Certified Accountants

Section A – This ONE question is compulsory and MUST be attempted

1 Talam Co, a listed company, aims to manufacture innovative engineering products which are environmentally friendly and sustainable. These products have been highly marketable because of their affordability. Talam Co's mission statement also states its desire to operate to the highest ethical standards. These commitments have meant that Talam Co has a very high reputation and a high share price compared to its competitors.

Talam Co is considering a new project, the Uwa Project, to manufacture drones for use in the agricultural industry, which are at least 50% biodegradable, at competitive prices. The drones will enable farmers to increase crop yields and reduce crop damage. Manufacture of drones is a new business area for Talam Co. The project is expected to last for four years.

Talam Co will also work on the Jigu Project (a follow-on project to the Uwa Project) to make 95%+ biodegradable drones. It is expected that the Jigu Project will last for a further five years after the Uwa Project has finished. If the Uwa Project is discontinued or sold sooner than four years, the Jigu Project could still be undertaken after four years.

Uwa Project

The following number of drones are expected to be produced and sold:

Year	1	2	3	4
Number of drones produced and sold	4,300	19,200	35,600	25,400

In the first year, for each drone, it is expected that the selling price will be $1,200 and the variable costs will be $480. The total annual direct fixed costs will be $2,700,000. After the first year, the selling price is expected to increase by 8% annually, the variable costs by 4% annually and the fixed costs by 10% annually, for the next three years. Training costs are expected to be 200% of the variable costs in year 1, 60% in year 2, and 10% in each of years 3 and 4. There is substantial uncertainty about the drones produced and sold, and Talam Co estimates the project to have a standard deviation of 30%.

At the start of every year, the Uwa Project will need working capital. In the first year, this will be 20% of sales revenue. In subsequent years, the project will require additional or a reduction in working capital of 10% for every $1 increase or decrease in sales revenue respectively. The working capital is expected to be fully recovered when the Uwa Project ceases.

The Uwa Project will need $35,000,000 of machinery to produce the drones at the start of the project. Tax allowable depreciation is available on the machinery at 15% per year on a straight-line basis. The machinery is expected to be sold for $7,000,000 (post-inflation) at the end of the project. Talam Co makes sufficient profits from its other activities to take advantage of any tax loss relief. Tax is paid in the year it falls due.

Jigu Project as a real option

Talam Co estimates that Jigu Project's cash flows are highly uncertain and its standard deviation is 50%. It is estimated that $60,000,000 will be required at the start of the project in four years' time. Using conventional net present value, Talam Co's best estimate is that net present value of the project will be $10,000,000 at the start of the project.

The following figures were estimated for the Jigu Project using the real options method.

Asset value (P_a) = $46,100,000 (to nearest 100,000)
Exercise price (P_e) = $60,000,000
Exercise date (t) = 4 years
Risk-free rate (r) = 2·30%
Volatility (s) = 50%

$d_1 = 0{\cdot}329$ $d_2 = -0{\cdot}671$ $N(d_1) = 0{\cdot}6288$ $N(d_2) = 0{\cdot}2510$

Call option value: $15,258,399

It can be assumed that the call option value is accurate.

Talam Co's finance director wants to know how the asset value of $46,100,000 has been estimated.

Honua Co's offer

Honua Co, whose main business is drone production, has approached Talam Co with an offer to buy the Uwa Project in its entirety from Talam Co, for $30,000,000 at the start of the third year of the project's life.

Talam Co has calculated some figures to assess the value of Honua Co's offer using the real options method, as follows:

$d_1 = 0{\cdot}779$ $d_2 = 0{\cdot}355$ $N(d_1) = 0{\cdot}7821$ $N(d_2) = 0{\cdot}6387$

Talam Co's finance director has requested that the value of Honua Co's offer is estimated using the real options method. She has also requested to know the amounts of the initial variables which would have been used to calculate the d_1, d_2, $N(d_1)$ and $N(d_2)$ figures.

It can be assumed that the d_1, d_2, $N(d_1)$ and $N(d_2)$ figures are accurate.

Additional information

Both Honua Co and Talam Co pay corporation tax at an annual rate of 20%. Talam Co has estimated Uwa Project's and Jigu Project's risk-adjusted cost of capital at 11%, based on Honua Co's asset beta. Talam Co believes that LIBOR, which is currently 2·30%, provides a good estimate of the risk-free rate of interest.

Required:

(a) Discuss how incorporating real options into net present value decisions may help Talam Co with its investment appraisal decisions. (5 marks)

(b) Prepare a report for the board of directors (BoD) of Talam Co which:

(i) Estimates, showing all relevant calculations, the net present value of the Uwa Project before considering the offer from Honua Co and the Jigu Project; (12 marks)

(ii) Addresses the requests made by the finance director about the initial variables and estimated value of the offer from Honua Co using the real options method; (9 marks)

(iii) Assesses whether the Uwa Project should be undertaken, using the results from, and discusses the assumptions made in, the calculations in (b)(i) and (b)(ii) above. (10 marks)

Professional marks will be awarded in part (b) for the format, structure and presentation of the report. (4 marks)

(c) At a recent trade show, the biodegradable drones attracted considerable interest from organisations worldwide. Nevertheless, some expressed concern about the drone price, which they felt was too high.

Talam Co estimates that even a modest reduction in each drone's price would make the projects unprofitable. Therefore, the operations director suggested that costs could be reduced if drone components were produced in Dunia, a country where Talam Co already gets some of its other products made.

However, the public relations director brought up an issue concerning Dunia. He said that several companies in Dunia, which Talam Co trades with, employ young teenage children. These companies pay the education fees for the teenagers and the companies argued that stopping this practice would harm the teenagers' families financially.

Required:

Discuss the impact on Talam Co and its aims arising from the possible sustainability and ethical issues above, and advise on how these issues may be addressed. (10 marks)

(50 marks)

Section B – BOTH questions are compulsory and MUST be attempted

2 Lurgshall Co is a listed electronics company. Lurgshall Co has recently appointed a new chief executive, who has a number of plans to expand the company. The chief executive also plans to look carefully at the costs of all departments in Lurgshall Co's head office, including the centralised treasury department.

The first major investment which the chief executive will oversee is an investment in facilities to produce applications-specific components. To finance the planned investment, it is likely that Lurgshall Co will have to borrow money. It is now 1 May. At present, it seems that Lurgshall Co will need to borrow $84 million on 1 September, for a period of six months, though both the amount and the period of borrowing are subject to some uncertainty. The treasurer plans to borrow the funds at a variable rate of LIBOR plus 50 basis points. LIBOR is currently 4·5% but is expected to rise by up to 0·6% between now and 1 September.

So far, the possibility of hedging a rise in LIBOR of 0·6% using a forward rate agreement or September $ futures has been investigated. The results of the calculations for these instruments were as follows:

4–10 Forward rate agreement from Birdam Bank: 5·38%

Three-month traded September $ futures: 5·36%

Lurgshall Co's treasurer also wants to consider using options on futures to hedge loans.

Although Lurgshall Co has not previously used swaps for hedging purposes, the treasurer has asked Birdam Bank to find a counterparty for a potential swap arrangement.

Relevant information about options and swaps is as follows:

Options

The current price for three-month $ September futures, $2 million contract size is 95·05. The price is quoted in basis points at 100 – annual % yield.

Options on three-month September $ futures, $2 million contract size, option premiums are in annual %

September calls	Strike price	September puts
0·132	95·25	0·411

It can be assumed that futures and options contracts are settled at the end of each month. Basis can be assumed to diminish to zero at contract maturity at a constant rate, based on monthly time intervals. It can also be assumed that there is no basis risk and there are no margin requirements.

Swap

Birdam Bank has found a possible counterparty to enter into a swap with Lurgshall Co. The counterparty can borrow at an annual floating rate of LIBOR + 1·5% or a fixed rate of 6·1%. Birdam Bank has quoted Lurgshall Co a notional fixed rate of 5·6% for it to borrow. Birdam Bank would charge a fee of 10 basis points to each party individually to act as the intermediary of the swap. Both parties would share equally the potential gains from the swap contract.

Treasury staffing

Lurgshall Co's new chief executive has made the following comments: 'I understand that the treasury department has a number of day-to-day responsibilities, including investing surplus funds for the short-term liquidity management and hedging against currency and interest rates. However, these tasks could all be carried out by the junior, less experienced, members of the department. I do not see why the department needs to employ experienced, expensive staff, as it does not contribute to the strategic success of the company.'

Required:

(a) Compare the results of hedging the $84 million, using the options and the swap, with the results already obtained using the forward rate agreement and futures, and comment on the results. Show all relevant calculations, including how the interest rate swap would work. (15 marks)

(b) Discuss the advantages and disadvantages of using swaps as a means of hedging interest rate risk for Lurgshall Co. (5 marks)

(c) Criticise the views of the chief executive about the work carried out by the treasury department and the staff required to do this work. (5 marks)

(25 marks)

3 Newimber Co is a listed company which has always manufactured formal clothing for adults and children. It obtained a listing ten years ago after years of steady growth. 70% of shares in the company are owned by its directors or their relatives, with the remaining 30% owned by external investors, including institutional investors.

Sportswear division

Eight years ago it set up a division to manufacture sportswear. This investment has been very successful and the sportswear division now accounts for 40% of total group revenue, having grown much quicker than the original formal clothing division.

Newimber Co's board has given divisional management at the sportswear division more authority over time, although the board has continued to make major policy and investment decisions relating to the division. Initially, relations between Newimber Co's board and management of the sportswear division were good, but there have been problems over the last couple of years. The sportswear division's management has been frustrated by the board's refusal to approve their recent investment plans on the grounds that they were too risky. In order to achieve operational efficiencies, the sportswear division's management would also like to pursue stricter policies for managing operational staff and suppliers than Newimber Co's board has so far allowed.

In addition, Newimber Co started to prepare an integrated report three years ago, but Newimber Co's board has had difficulties in obtaining all the information it requires for the report from the sportswear division.

Restructuring

A few months ago, the management of the sportswear division approached Newimber Co's board with a proposal for a management buyout of the sportswear division. However, the price the sportswear division's management was able to offer was insufficient to persuade Newimber Co's board to sell the sportswear division to them.

Newimber Co's board has, subsequently, decided that the sportswear division should be demerged into a new company, Poynins Co. The shareholders and proportion of shares held would be the same for Poynins Co as currently for Newimber Co. The sportswear division's senior management team would become the board of Poynins Co and Poynins Co would seek an immediate listing on the same stock exchange as Newimber Co.

Financial information

The market capitalisation of Newimber Co's share capital is currently $585 million. Newimber Co also currently has $200 million 5·9% loan notes. The loan notes are redeemable in five years' time at a premium of 5%. Newimber Co's equity beta is currently estimated at 1·4. Newimber Co's current cost of equity is 11·8% and its current before-tax cost of debt is 4·5%.

The asset beta of the formal clothing division is estimated to be 1·21. The weighting in estimating Newimber Co's overall asset beta is 60% for the formal clothing division to 40% for the sportswear division. The debt beta can be assumed to be zero.

In return for 40% of the issued share capital of Newimber Co, its current shareholders will receive 100% of the issued share capital of Poynins Co, corresponding to the assets and liabilities being transferred. The shares in Newimber Co which shareholders have given up will be cancelled. After the demerger, Newimber Co's new market capitalisation can be assumed to be $351 million. Poynins Co will have no long-term debt, the liability for the $200 million loan notes remaining with Newimber Co.

The current risk-free rate of return is estimated to be 3·4%. The market risk premium is estimated to be 6%. A tax rate of 28% is applicable to all companies.

The sportswear division currently has $36 million operating cash flows. Its managers believe that operating cash flows can increase by the following rates once Poynins Co has been listed:

Year	%
1	25
2	20
3	15
4 onwards	2

The sportswear division's managers believe that Poynins Co will require a $20 million investment of additional assets in Year 1, rising to $22 million in each of Years 2 and 3, and to $25 million annually from Year 4 onwards.

Required:

(a) Discuss the advantages and disadvantages of demerging the sportswear division into a new company. (5 marks)

(b) Calculate:

- **The change in the weighted average cost of capital of Newimber Co if the demerger of the sportswear division takes place;**
- **The valuation of Poynins Co using free cash flows, based on the information and assumptions given and briefly discuss your results.** (15 marks)

(c) Discuss the factors which may determine the policies Poynins Co should adopt for communication of information to its shareholders and other significant stakeholders. (5 marks)

(25 marks)

Formulae

Modigliani and Miller Proposition 2 (with tax)

$$k_e = k_e^i + (1 - T)(k_e^i - k_d)\frac{V_d}{V_e}$$

The Capital Asset Pricing Model

$$E(r_i) = R_f + \beta_i(E(r_m) - R_f)$$

The asset beta formula

$$\beta_a = \left[\frac{V_e}{(V_e + V_d(1-T))}\beta_e\right] + \left[\frac{V_d(1-T)}{(V_e + V_d(1-T))}\beta_d\right]$$

The Growth Model

$$P_o = \frac{D_o(1+g)}{(r_e - g)}$$

Gordon's growth approximation

$$g = br_e$$

The weighted average cost of capital

$$WACC = \left[\frac{V_e}{V_e + V_d}\right]k_e + \left[\frac{V_d}{V_e + V_d}\right]k_d(1-T)$$

The Fisher formula

$$(1+i) = (1+r)(1+h)$$

Purchasing power parity and interest rate parity

$$S_1 = S_0 x \frac{(1+h_c)}{(1+h_b)} \qquad F_0 = S_0 x \frac{(1+i_c)}{(1+i_b)}$$

Modified Internal Rate of Return

$$MIRR = \left[\frac{PV_R}{PV_I}\right]^{\frac{1}{n}} \left(1 + r_e\right) - 1$$

The Black-Scholes option pricing model

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

Where:

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

$$d_2 = d_1 - s\sqrt{t}$$

The Put Call Parity relationship

$$p = c - P_a + P_e e^{-rt}$$

Present Value Table

Present value of 1 i.e. $(1 + r)^{-n}$

Where r = discount rate
n = number of periods until payment

Discount rate (r)

Periods (n)	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	
1	0·990	0·980	0·971	0·962	0·952	0·943	0·935	0·926	0·917	0·909	1
2	0·980	0·961	0·943	0·925	0·907	0·890	0·873	0·857	0·842	0·826	2
3	0·971	0·942	0·915	0·889	0·864	0·840	0·816	0·794	0·772	0·751	3
4	0·961	0·924	0·888	0·855	0·823	0·792	0·763	0·735	0·708	0·683	4
5	0·951	0·906	0·863	0·822	0·784	0·747	0·713	0·681	0·650	0·621	5
6	0·942	0·888	0·837	0·790	0·746	0·705	0·666	0·630	0·596	0·564	6
7	0·933	0·871	0·813	0·760	0·711	0·665	0·623	0·583	0·547	0·513	7
8	0·923	0·853	0·789	0·731	0·677	0·627	0·582	0·540	0·502	0·467	8
9	0·914	0·837	0·766	0·703	0·645	0·592	0·544	0·500	0·460	0·424	9
10	0·905	0·820	0·744	0·676	0·614	0·558	0·508	0·463	0·422	0·386	10
11	0·896	0·804	0·722	0·650	0·585	0·527	0·475	0·429	0·388	0·350	11
12	0·887	0·788	0·701	0·625	0·557	0·497	0·444	0·397	0·356	0·319	12
13	0·879	0·773	0·681	0·601	0·530	0·469	0·415	0·368	0·326	0·290	13
14	0·870	0·758	0·661	0·577	0·505	0·442	0·388	0·340	0·299	0·263	14
15	0·861	0·743	0·642	0·555	0·481	0·417	0·362	0·315	0·275	0·239	15

(n)	11%	12%	13%	14%	15%	16%	17%	18%	19%	20%	
1	0·901	0·893	0·885	0·877	0·870	0·862	0·855	0·847	0·840	0·833	1
2	0·812	0·797	0·783	0·769	0·756	0·743	0·731	0·718	0·706	0·694	2
3	0·731	0·712	0·693	0·675	0·658	0·641	0·624	0·609	0·593	0·579	3
4	0·659	0·636	0·613	0·592	0·572	0·552	0·534	0·516	0·499	0·482	4
5	0·593	0·567	0·543	0·519	0·497	0·476	0·456	0·437	0·419	0·402	5
6	0·535	0·507	0·480	0·456	0·432	0·410	0·390	0·370	0·352	0·335	6
7	0·482	0·452	0·425	0·400	0·376	0·354	0·333	0·314	0·296	0·279	7
8	0·434	0·404	0·376	0·351	0·327	0·305	0·285	0·266	0·249	0·233	8
9	0·391	0·361	0·333	0·308	0·284	0·263	0·243	0·225	0·209	0·194	9
10	0·352	0·322	0·295	0·270	0·247	0·227	0·208	0·191	0·176	0·162	10
11	0·317	0·287	0·261	0·237	0·215	0·195	0·178	0·162	0·148	0·135	11
12	0·286	0·257	0·231	0·208	0·187	0·168	0·152	0·137	0·124	0·112	12
13	0·258	0·229	0·204	0·182	0·163	0·145	0·130	0·116	0·104	0·093	13
14	0·232	0·205	0·181	0·160	0·141	0·125	0·111	0·099	0·088	0·078	14
15	0·209	0·183	0·160	0·140	0·123	0·108	0·095	0·084	0·074	0·065	15

Annuity Table

Present value of an annuity of 1 i.e. $\frac{1-(1+r)^{-n}}{r}$

Where r = discount rate
n = number of periods

Discount rate (r)

Periods (n)	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	
1	0·990	0·980	0·971	0·962	0·952	0·943	0·935	0·926	0·917	0·909	1
2	1·970	1·942	1·913	1·886	1·859	1·833	1·808	1·783	1·759	1·736	2
3	2·941	2·884	2·829	2·775	2·723	2·673	2·624	2·577	2·531	2·487	3
4	3·902	3·808	3·717	3·630	3·546	3·465	3·387	3·312	3·240	3·170	4
5	4·853	4·713	4·580	4·452	4·329	4·212	4·100	3·993	3·890	3·791	5
6	5·795	5·601	5·417	5·242	5·076	4·917	4·767	4·623	4·486	4·355	6
7	6·728	6·472	6·230	6·002	5·786	5·582	5·389	5·206	5·033	4·868	7
8	7·652	7·325	7·020	6·733	6·463	6·210	5·971	5·747	5·535	5·335	8
9	8·566	8·162	7·786	7·435	7·108	6·802	6·515	6·247	5·995	5·759	9
10	9·471	8·983	8·530	8·111	7·722	7·360	7·024	6·710	6·418	6·145	10
11	10·368	9·787	9·253	8·760	8·306	7·887	7·499	7·139	6·805	6·495	11
12	11·255	10·575	9·954	9·385	8·863	8·384	7·943	7·536	7·161	6·814	12
13	12·134	11·348	10·635	9·986	9·394	8·853	8·358	7·904	7·487	7·103	13
14	13·004	12·106	11·296	10·563	9·899	9·295	8·745	8·244	7·786	7·367	14
15	13·865	12·849	11·938	11·118	10·380	9·712	9·108	8·559	8·061	7·606	15

(n)	11%	12%	13%	14%	15%	16%	17%	18%	19%	20%	
1	0·901	0·893	0·885	0·877	0·870	0·862	0·855	0·847	0·840	0·833	1
2	1·713	1·690	1·668	1·647	1·626	1·605	1·585	1·566	1·547	1·528	2
3	2·444	2·402	2·361	2·322	2·283	2·246	2·210	2·174	2·140	2·106	3
4	3·102	3·037	2·974	2·914	2·855	2·798	2·743	2·690	2·639	2·589	4
5	3·696	3·605	3·517	3·433	3·352	3·274	3·199	3·127	3·058	2·991	5
6	4·231	4·111	3·998	3·889	3·784	3·685	3·589	3·498	3·410	3·326	6
7	4·712	4·564	4·423	4·288	4·160	4·039	3·922	3·812	3·706	3·605	7
8	5·146	4·968	4·799	4·639	4·487	4·344	4·207	4·078	3·954	3·837	8
9	5·537	5·328	5·132	4·946	4·772	4·607	4·451	4·303	4·163	4·031	9
10	5·889	5·650	5·426	5·216	5·019	4·833	4·659	4·494	4·339	4·192	10
11	6·207	5·938	5·687	5·453	5·234	5·029	4·836	4·656	4·486	4·327	11
12	6·492	6·194	5·918	5·660	5·421	5·197	4·988	4·793	4·611	4·439	12
13	6·750	6·424	6·122	5·842	5·583	5·342	5·118	4·910	4·715	4·533	13
14	6·982	6·628	6·302	6·002	5·724	5·468	5·229	5·008	4·802	4·611	14
15	7·191	6·811	6·462	6·142	5·847	5·575	5·324	5·092	4·876	4·675	15

[P.T.O.

Standard normal distribution table

	0·00	0·01	0·02	0·03	0·04	0·05	0·06	0·07	0·08	0·09
0·0	0·0000	0·0040	0·0080	0·0120	0·0160	0·0199	0·0239	0·0279	0·0319	0·0359
0·1	0·0398	0·0438	0·0478	0·0517	0·0557	0·0596	0·0636	0·0675	0·0714	0·0753
0·2	0·0793	0·0832	0·0871	0·0910	0·0948	0·0987	0·1026	0·1064	0·1103	0·1141
0·3	0·1179	0·1217	0·1255	0·1293	0·1331	0·1368	0·1406	0·1443	0·1480	0·1517
0·4	0·1554	0·1591	0·1628	0·1664	0·1700	0·1736	0·1772	0·1808	0·1844	0·1879
0·5	0·1915	0·1950	0·1985	0·2019	0·2054	0·2088	0·2123	0·2157	0·2190	0·2224
0·6	0·2257	0·2291	0·2324	0·2357	0·2389	0·2422	0·2454	0·2486	0·2517	0·2549
0·7	0·2580	0·2611	0·2642	0·2673	0·2704	0·2734	0·2764	0·2794	0·2823	0·2852
0·8	0·2881	0·2910	0·2939	0·2967	0·2995	0·3023	0·3051	0·3078	0·3106	0·3133
0·9	0·3159	0·3186	0·3212	0·3238	0·3264	0·3289	0·3315	0·3340	0·3365	0·3389
1·0	0·3413	0·3438	0·3461	0·3485	0·3508	0·3531	0·3554	0·3577	0·3599	0·3621
1·1	0·3643	0·3665	0·3686	0·3708	0·3729	0·3749	0·3770	0·3790	0·3810	0·3830
1·2	0·3849	0·3869	0·3888	0·3907	0·3925	0·3944	0·3962	0·3980	0·3997	0·4015
1·3	0·4032	0·4049	0·4066	0·4082	0·4099	0·4115	0·4131	0·4147	0·4162	0·4177
1·4	0·4192	0·4207	0·4222	0·4236	0·4251	0·4265	0·4279	0·4292	0·4306	0·4319
1·5	0·4332	0·4345	0·4357	0·4370	0·4382	0·4394	0·4406	0·4418	0·4429	0·4441
1·6	0·4452	0·4463	0·4474	0·4484	0·4495	0·4505	0·4515	0·4525	0·4535	0·4545
1·7	0·4554	0·4564	0·4573	0·4582	0·4591	0·4599	0·4608	0·4616	0·4625	0·4633
1·8	0·4641	0·4649	0·4656	0·4664	0·4671	0·4678	0·4686	0·4693	0·4699	0·4706
1·9	0·4713	0·4719	0·4726	0·4732	0·4738	0·4744	0·4750	0·4756	0·4761	0·4767
2·0	0·4772	0·4778	0·4783	0·4788	0·4793	0·4798	0·4803	0·4808	0·4812	0·4817
2·1	0·4821	0·4826	0·4830	0·4834	0·4838	0·4842	0·4846	0·4850	0·4854	0·4857
2·2	0·4861	0·4864	0·4868	0·4871	0·4875	0·4878	0·4881	0·4884	0·4887	0·4890
2·3	0·4893	0·4896	0·4898	0·4901	0·4904	0·4906	0·4909	0·4911	0·4913	0·4916
2·4	0·4918	0·4920	0·4922	0·4925	0·4927	0·4929	0·4931	0·4932	0·4934	0·4936
2·5	0·4938	0·4940	0·4941	0·4943	0·4945	0·4946	0·4948	0·4949	0·4951	0·4952
2·6	0·4953	0·4955	0·4956	0·4957	0·4959	0·4960	0·4961	0·4962	0·4963	0·4964
2·7	0·4965	0·4966	0·4967	0·4968	0·4969	0·4970	0·4971	0·4972	0·4973	0·4974
2·8	0·4974	0·4975	0·4976	0·4977	0·4977	0·4978	0·4979	0·4979	0·4980	0·4981
2·9	0·4981	0·4982	0·4982	0·4983	0·4984	0·4984	0·4985	0·4985	0·4986	0·4986
3·0	0·4987	0·4987	0·4987	0·4988	0·4988	0·4989	0·4989	0·4989	0·4990	0·4990

This table can be used to calculate $N(d)$, the cumulative normal distribution functions needed for the Black-Scholes model of option pricing. If $d_i > 0$, add 0·5 to the relevant number above. If $d_i < 0$, subtract the relevant number above from 0·5.

End of Question Paper