## CIMA

## Performance Pillar

## P2 - Performance Management

Wednesday 26 February 2014

## Instructions to candidates

| You are allowed three hours to answer this question paper. |
| :--- |
| You are allowed 20 minutes reading time before the examination begins <br> during which you should read the question paper and, if you wish, make <br> annotations on the question paper. However, you will not be allowed, under <br> any circumstances, open the answer book and start writing or use your <br> calculator during this reading time. |
| You are strongly advised to carefully read ALL the question requirements <br> before attempting the question concerned (that is all parts and/or sub- <br> questions). |
| ALL answers must be written in the answer book. Answers written on the <br> question paper will not be submitted for marking. |
| You should show all workings as marks are available for the method you use. |
| ALL QUESTIONS ARE comPULSORY. |
| Section A comprises 5 questions and is on pages 2 to 7. |
| Section B comprises 2 questions and is on pages 8 to 11. |
| Maths tables and formulae are provided on pages 13 to 16. |
| The list of verbs as published in the syllabus is given for reference on page <br> 19. |
| Write your candidate number, the paper number and examination subject title <br> in the spaces provided on the front of the answer book. Also write your <br> contact ID and name in the space provided in the right hand margin and seal <br> to close. |

Tick the appropriate boxes on the front of the answer book to indicate which questions you have answered.


SECTION A - 50 MARKS

## [You are advised to spend no longer than 18 minutes on each question in this section.]

ANSWER ALL FIVE QUESTIONS IN THIS SECTION. EACH QUESTION IS WORTH 10 MARKS. YOU SHOULD SHOW YOUR WORKINGS AS MARKS ARE AVAILABLE FOR THE METHOD YOU USE.

## Question One

WTI is planning to launch a new component. Production volume will be limited, with only 128 components to be produced in total.
WTI expects the manufacture of the first component to take 25 direct labour hours. It is anticipated there will be a $90 \%$ learning curve that will continue until all 128 components have been produced. Direct labour is paid at a rate of $\$ 15$ per hour.

Non labour-related costs are expected to be $\$ 265$ per component; this will apply to all 128 components produced. There are no product-specific fixed costs associated with this new component.

WTI is going to use a target costing approach for the new component. Based on the market research it has undertaken, WTI plans to sell the components for $\$ 530$ each. WTI requires an average profit margin of $20 \%$ of the selling price over the life of this new component.

Note: The learning index for a $90 \%$ learning curve $=-0.152$

## Required:

(a) Calculate the time required to produce the $128^{\text {th }}$ component.
(b) Calculate the value of any cost gap between the target cost of 128 components in total and the expected cost of 128 components in total.
(c) Calculate the rate of learning required to close the cost gap you calculated in part (b) in order to achieve the required profit margin of 20\%.
(4 marks)
(Total for Question One = 10 marks)

## Question Two

PB is a car production company. PB uses a system of standard costing to set its budgets. Budgets are set annually by the Finance department and approved by the Board of Directors of PB. The Finance department prepares variance reports each month for review at the Board of Directors meeting, where actual performance is monitored by comparison to budgeted figures.
A new Finance Director has recently joined PB from a competitor organisation where there was a Total Quality Management culture. The new Finance Director of PB is keen to discuss the implementation of Kaizen costing at the next meeting of the Board of Directors. The new Finance Director would like to review the current planning and control system at PB with a view to making changes so that it could support Kaizen costing concepts.

## Required:

(a) Explain TWO basic principles of Total Quality Management.
(4 marks)
(b) Explain THREE changes required to PB's planning and control system to support the adoption of Kaizen costing concepts.

Section A continues on the next page

## Question Three

APZ has recently opened a fast-food restaurant in a small town. Fast-food restaurants are characterised by their quick food service.

The fast-food restaurant market in the town is dominated by a small number of long established restaurants. APZ is seeking to grow its business and attract the town's residents with its burger meals.

The performance report for the first month of business is to be presented at the restaurant's monthly management meeting.

A draft of the performance report for the first month of business is reproduced below:

|  | Budget | Actual | Variance |
| :--- | :---: | :---: | :---: |
| Sales (number of meals) | 6,000 | 5,400 | $(600)$ |
|  | $\$$ | $\$$ | $\$$ |
| Revenue | 45,000 | 40,365 | $(4,635)$ |
| Variable costs | 26,400 | 24,632 | 1,768 |
| Fixed costs | 5,250 | 4,950 | 300 |
| Profit | 13,350 | 10,783 | $(2,567)$ |

The management accountant at APZ has realised that the size of the fast-food market that was used to derive the budget number of meals to be sold has been over-estimated. The management accountant has calculated the value of the sales volume contribution planning variance to be $\$ 2,480$ adverse.

## Required:

(a)
(i) Prepare a revised budget based on the new estimate of the market.
(3 marks)
(ii) Prepare a performance report for the month based on a flexed budget.
(3 marks)
(b) Explain TWO non-financial measures that APZ could use to monitor the performance of the new fast-food restaurant.
(4 marks)
(Total for Question Three = 10 marks)

## Question Four

SAF is about to launch a new model of smart phone, Product $Z$. Product $Z$ is the company's first smart phone and features unique technology developed by SAF. SAF expects the unique technology and exclusive design to attract both new and existing SAF customers.

Given the unique nature of this smart phone, SAF has no experience of the price demand relationship of this product. However, based on experience from previous products, it expects that during the product's introductory phase, at a selling price of $\$ 200$, the demand would be 20,000 units per month. For every $\$ 32.50$ increase in selling price the monthly demand would reduce by 2,500 units, and for every $\$ 32.50$ decrease in selling price the monthly demand would increase by 2,500 units.
The variable costs of production for one unit of Product $Z$ are as follows:
Direct materials \$85

Direct labour \$56
Variable overhead \$20
SAF is planning an advertising campaign during the introductory phase of product $Z$. The total cost of the advertising campaign is yet to be finalised with the advertising agency. However, after deducting the cost of this advertising, the Managing Director requires a minimum profit of $\$ 2,500,000$ for the introductory phase.

Note: the introductory phase of Product $Z$ is expected to have a duration of three months.
There are no other specific fixed costs associated with Product $Z$.

## Required:

(a) Calculate the maximum cost of the advertising campaign in order to achieve the Managing Director's profit requirement for the introductory phase of Product $Z$.

Note: The company will set the price for a unit of Product $Z$ to maximise profit during the introductory phase.

If $P=a-b x$ then $M R=a-2 b x$
(6 marks)
(b) Explain TWO reasons why it may not be appropriate to set the introductory price of Product $Z$ using the assumptions contained in the profit-maximisation model you used in part (a).
(Total for Question Four = 10 marks)

## Question Five

TES operates a chain of health clubs in its home country. Managers at health clubs receive a quarterly bonus if their health club achieves or exceeds ALL of the following financial targets:

| ROCE | $8 \%$ (based on net assets) |
| :--- | ---: |
| Asset turnover | $40 \%$ |
| Operating profit margin | $20 \%$ |

Summary actual performance for Quarter 3 of the current year for Health Club E is detailed below:

## Quarter 3

Revenue
\$36,000
Staff costs
\$12,000
Other fixed costs
\$22,000
Net assets \$110,000
Number of customers

The quarterly financial targets are set by the head office finance team and all health clubs are given the same target. TES is currently forecasting the performance of its health clubs in Quarter 4.

TES will use the following information to forecast the performance of each of its health clubs in Quarter 4:

- The average revenue per customer will increase by $10 \%$ on Quarter 3.
- Customer numbers will increase by 5\% on Quarter 3.
- Staff costs and net assets are expected to remain at the same level as Quarter 3.
- Other fixed costs are expected to decrease by 5\% on Quarter 3.
- Staff and other costs are fixed (they are not related to the number of customers).


## Required:

(a) Prepare calculations to show whether the manager of Health Club E is expected to receive the bonus in Quarter 4 based on the forecast performance.

Note: you should calculate operating profit margin, ROCE and asset turnover for Quarter 4.
(6 marks)

The manager of Health Club E is dissatisfied with the quarterly bonus system and does not perceive it to be fair. The manager argues that the financial targets are based on a national view of all TES health clubs and do not take account of specific local circumstances. For example, Health Club E is located in a less affluent area of the country. The manager of Health Club E would like to see participation from health club managers in the development of quarterly financial targets.
(b) Discuss the potential impact for TES of involving the health club managers in the production of their quarterly financial targets.
(4 marks)
(Total for Question Five = 10 marks)
(Total for Section A = 50 marks)

End of Section A

Section B starts on page 8

SECTION B - 50 MARKS
[You are advised to spend no longer than 45 minutes on each question in this section.]

## ANSWER BOTH QUESTIONS IN THIS SECTION. EACH QUESTION IS WORTH 25 MARKS. YOU SHOULD SHOW YOUR WORKINGS AS MARKS ARE AVAILABLE FOR THE METHOD YOU USE.

## Question Six

GF is a company that manufactures clothes for the fashion industry. The fashion industry is fast moving and consumer demand can change quickly due to the emergence of new trends.

GF manufactures three items of clothing: the $S$, the $T$ and the $B$ using the same resources but in different amounts.

Budget information per unit is as follows:

|  | S | T | B |
| :--- | ---: | ---: | ---: |
|  | $\mathbf{\$}$ | $\$$ | $\$$ |
| Selling price | 250 | 40 | 100 |
| Direct materials (\$20 per $\mathrm{m}^{2}$ ) | 100 | 10 | 30 |
| Direct labour (\$12 per hour) | 36 | 12 | 27 |
| Variable overhead (\$3 per machine hour) | 9 | 3 | 6.75 |

Total fixed costs are \$300,000 per month.
Included in the original budget constructed at the start of the year, was the sales demand for the month of March as shown below:

|  | $\mathbf{S}$ | $\mathbf{T}$ | $\mathbf{B}$ |
| :--- | :---: | :---: | :---: |
| Demand in March (units) | 2,000 | 6,000 | 4,000 |

After the original budget had been constructed, items of clothing $S, T$ and $B$ have featured in a fashion magazine. As a result of this, a new customer (a fashion retailer), has ordered 1,000 units each of $\mathrm{S}, \mathrm{T}$ and B for delivery in March. The budgeted demand shown above does not include this order from the new customer.

In March there will be limited resources available. Resources will be limited to:
$\begin{array}{ll}\text { Direct materials } & 14,500 \mathrm{~m}^{2} \\ \text { Direct labour } & 30,000 \text { hours }\end{array}$
There will be no opening inventory of material, work in progress or finished goods in March.

## Required:

(a) Produce a statement that shows the optimal production plan and the resulting profit or loss for March.

Note: you should assume that the new customer's order must be supplied in full.
(10 marks)
(b) Explain TWO issues that should be considered before the production plan, that you produced in part (a), is implemented.

The Board of Directors have now addressed the shortage of key resources at GF to ensure that production will meet demand in April. The production plan for the month of April is shown below:

|  | $\mathbf{S}$ | $\mathbf{T}$ | $\mathbf{B}$ |
| :---: | :---: | :---: | :---: |
| Production (units) | 4,000 | 5,000 | 4,000 |

## Required:

(c) For April,
(i) Calculate the breakeven sales revenue for the given product mix in the production plan.
(ii) Calculate the margin of safety percentage.
(iii) Explain THREE limitations of breakeven analysis for GF.

## Section B continues on the next page

## Question Seven

SBA is a company that produces televisions and components for televisions. The company has two divisions, Division $S$ and Division B.

Division S manufactures components for televisions. Division S sells components to division $B$ and to external customers. Division B uses five of the components in each of the televisions that it manufactures, and sells televisions directly to external customers.

## Division S <br> Budgeted variable manufacturing cost per component: \$ <br> Direct material 14 <br> Direct labour 18 <br> Variable overhead 12

The following information relating to next year is also available:

| Fixed costs | $\$ 560,000$ |
| :--- | :--- |
| Production capacity | 175,000 components |
| External demand | 150,000 components |
| Potential demand from Division B | 80,000 components |

The anticipated external market price for a component is $\$ 50$.
Division B \$

Sales price 450
Budgeted variable manufacturing cost per television
Direct material
Direct material 40
$\begin{array}{ll}\text { Variable overhead } & 16\end{array}$

In addition to the variable costs above, each television produced needs five components
Fixed costs are budgeted to be $\$ 1,460,000$ for next year. Annual sales of televisions are expected to be 16,000 units.

## Transfer Pricing Policy

Transfer prices are set at opportunity cost.
Division S must satisfy the demand of Division B before selling components externally.
Division B is allowed to purchase components from Division S or from external suppliers.

## Required:

(a) Assuming that Division $B$ buys all the components it requires from Division S:

Produce a profit statement for each division detailing sales and costs, showing external sales and internal company transfers separately where appropriate.
(b) A specialist external supplier has approached Division B and offered to supply 80,000 components at a price of $\$ 42$ each. The components fulfil the same function as those manufactured by Division S . The manager of Division B has accepted the offer and has agreed to buy all the components it requires from this supplier.
(i) Produce a revised profit statement for each division and for the total SBA company.
(6 marks)
Division $S$ has just received an enquiry from a new customer for the production of 25,000 components. The manager of Division $S$ requires a total profit for the year for the division of $\$ 450,000$.
(ii) Calculate the minimum price per component to sell the 25,000 components to the new customer that would enable the manager of Division S to meet the profit target.

Note: this order will have no effect on the divisional fixed costs and no impact on the 150,000 components Division S sells to its existing external customers at $\$ 50$ per component. Division $B$ will continue to purchase the 80,000 components it requires from the specialist external supplier.
(4 marks)
(c) Discuss the potential implications for SBA of outsourcing the production of one type of component that it manufactures.

## Maths tables and formulae are on pages 13 to 16

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Present value of 1 unit of currency, that is $(1+r)^{-n}$ where $r=$ interest rate; $n=$ number of periods until payment or receipt.

| Periods |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $(n)$ | Interest rates $(r)$ |  |  |  |  |  |  |  |  |  |  |
|  | $1 \%$ | $2 \%$ | $3 \%$ | $4 \%$ | $5 \%$ | $6 \%$ | $7 \%$ | $8 \%$ | $9 \%$ | $10 \%$ |  |
| 1 | 0.990 | 0.980 | 0.971 | 0.962 | 0.952 | 0.943 | 0.935 | 0.926 | 0.917 | 0.909 |  |
| 2 | 0.980 | 0.961 | 0.943 | 0.925 | 0.907 | 0.890 | 0.873 | 0.857 | 0.842 | 0.826 |  |
| 3 | 0.971 | 0.942 | 0.915 | 0.889 | 0.864 | 0.840 | 0.816 | 0.794 | 0.772 | 0.751 |  |
| 4 | 0.961 | 0.924 | 0.888 | 0.855 | 0.823 | 0.792 | 0.763 | 0.735 | 0.708 | 0.683 |  |
| 5 | 0.951 | 0.906 | 0.863 | 0.822 | 0.784 | 0.747 | 0.713 | 0.681 | 0.650 | 0.621 |  |
| 6 | 0.942 | 0.888 | 0.837 | 0.790 | 0.746 | 0705 | 0.666 | 0.630 | 0.596 | 0.564 |  |
| 7 | 0.933 | 0.871 | 0.813 | 0.760 | 0.711 | 0.665 | 0.623 | 0.583 | 0.547 | 0.513 |  |
| 8 | 0.923 | 0.853 | 0.789 | 0.731 | 0.677 | 0.627 | 0.582 | 0.540 | 0.502 | 0.467 |  |
| 9 | 0.914 | 0.837 | 0.766 | 0.703 | 0.645 | 0.592 | 0.544 | 0.500 | 0.460 | 0.424 |  |
| 10 | 0.905 | 0.820 | 0.744 | 0.676 | 0.614 | 0.558 | 0.508 | 0.463 | 0.422 | 0.386 |  |
| 11 | 0.896 | 0.804 | 0.722 | 0.650 | 0.585 | 0.527 | 0.475 | 0.429 | 0.388 | 0.350 |  |
| 12 | 0.887 | 0.788 | 0.701 | 0.625 | 0.557 | 0.497 | 0.444 | 0.397 | 0.356 | 0.319 |  |
| 13 | 0.879 | 0.773 | 0.681 | 0.601 | 0.530 | 0.469 | 0.415 | 0.368 | 0.326 | 0.290 |  |
| 14 | 0.870 | 0.758 | 0.661 | 0.577 | 0.505 | 0.442 | 0.388 | 0.340 | 0.299 | 0.263 |  |
| 15 | 0.861 | 0.743 | 0.642 | 0.555 | 0.481 | 0.417 | 0.362 | 0.315 | 0.275 | 0.239 |  |
| 16 | 0.853 | 0.728 | 0.623 | 0.534 | 0.458 | 0.394 | 0.339 | 0.292 | 0.252 | 0.218 |  |
| 17 | 0.844 | 0.714 | 0.605 | 0.513 | 0.436 | 0.371 | 0.317 | 0.270 | 0.231 | 0.198 |  |
| 18 | 0.836 | 0.700 | 0.587 | 0.494 | 0.416 | 0.350 | 0.296 | 0.250 | 0.212 | 0.180 |  |
| 19 | 0.828 | 0.686 | 0.570 | 0.475 | 0.396 | 0.331 | 0.277 | 0.232 | 0.194 | 0.164 |  |
| 20 | 0.820 | 0.673 | 0.554 | 0.456 | 0.377 | 0.312 | 0.258 | 0.215 | 0.178 | 0.149 |  |


| Periods | Interest rates $(r)$ |  |  |  |  |  |  |  |  |  |
| :---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: |
|  | $11 \%$ | $12 \%$ | $13 \%$ | $14 \%$ | $15 \%$ | $16 \%$ | $17 \%$ | $18 \%$ | $19 \%$ | $20 \%$ |
| 1 | 0.901 | 0.893 | 0.885 | 0.877 | 0.870 | 0.862 | 0.855 | 0.847 | 0.840 | 0.833 |
| 2 | 0.812 | 0.797 | 0.783 | 0.769 | 0.756 | 0.743 | 0.731 | 0.718 | 0.706 | 0.694 |
| 3 | 0.731 | 0.712 | 0.693 | 0.675 | 0.658 | 0.641 | 0.624 | 0.609 | 0.593 | 0.579 |
| 4 | 0.659 | 0.636 | 0.613 | 0.592 | 0.572 | 0.552 | 0.534 | 0.516 | 0.499 | 0.482 |
| 5 | 0.593 | 0.567 | 0.543 | 0.519 | 0.497 | 0.476 | 0.456 | 0.437 | 0.419 | 0.402 |
| 6 | 0.535 | 0.507 | 0.480 | 0.456 | 0.432 | 0.410 | 0.390 | 0.370 | 0.352 | 0.335 |
| 7 | 0.482 | 0.452 | 0.425 | 0.400 | 0.376 | 0.354 | 0.333 | 0.314 | 0.296 | 0.279 |
| 8 | 0.434 | 0.404 | 0.376 | 0.351 | 0.327 | 0.305 | 0.285 | 0.266 | 0.249 | 0.233 |
| 9 | 0.391 | 0.361 | 0.333 | 0.308 | 0.284 | 0.263 | 0.243 | 0.225 | 0.209 | 0.194 |
| 10 | 0.352 | 0.322 | 0.295 | 0.270 | 0.247 | 0.227 | 0.208 | 0.191 | 0.176 | 0.162 |
| 11 | 0.317 | 0.287 | 0.261 | 0.237 | 0.215 | 0.195 | 0.178 | 0.162 | 0.148 | 0.135 |
| 12 | 0.286 | 0.257 | 0.231 | 0.208 | 0.187 | 0.168 | 0.152 | 0.137 | 0.124 | 0.112 |
| 13 | 0.258 | 0.229 | 0.204 | 0.182 | 0.163 | 0.145 | 0.130 | 0.116 | 0.104 | 0.093 |
| 14 | 0.232 | 0.205 | 0.181 | 0.160 | 0.141 | 0.125 | 0.111 | 0.099 | 0.088 | 0.078 |
| 15 | 0.209 | 0.183 | 0.160 | 0.140 | 0.123 | 0.108 | 0.095 | 0.084 | 0.079 | 0.065 |
| 16 | 0.188 | 0.163 | 0.141 | 0.123 | 0.107 | 0.093 | 0.081 | 0.071 | 0.062 | 0.054 |
| 17 | 0.170 | 0.146 | 0.125 | 0.108 | 0.093 | 0.080 | 0.069 | 0.060 | 0.052 | 0.045 |
| 18 | 0.153 | 0.130 | 0.111 | 0.095 | 0.081 | 0.069 | 0.059 | 0.051 | 0.044 | 0.038 |
| 19 | 0.138 | 0.116 | 0.098 | 0.083 | 0.070 | 0.060 | 0.051 | 0.043 | 0.037 | 0.031 |
| 20 | 0.124 | 0.104 | 0.087 | 0.073 | 0.061 | 0.051 | 0.043 | 0.037 | 0.031 | 0.026 |

## CUMULATIVE PRESENT VALUE TABLE

Cumulative present value of 1 unit of currency per annum, Receivable or Payable at the end of each year for $n$ years $\frac{1-(1+r)^{-n}}{r}$

| Periods |  |  |  |  |  |  |  |  |  |  |
| :---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | :--- |
| $(n)$ | Interest rates $(r)$ |  |  |  |  |  |  |  |  |  |
|  | $1 \%$ | $2 \%$ | $3 \%$ | $4 \%$ | $5 \%$ | $\%$ | $7 \%$ | $8 \%$ | $9 \%$ | $10 \%$ |
| 1 | 0.990 | 0.980 | 0.971 | 0.962 | 0.952 | 0.943 | 0.935 | 0.926 | 0.917 | 0.909 |
| 2 | 1.970 | 1.942 | 1.913 | 1.886 | 1.859 | 1.833 | 1.808 | 1.783 | 1.759 | 1.736 |
| 3 | 2.941 | 2.884 | 2.829 | 2.775 | 2.723 | 2.673 | 2.624 | 2.577 | 2.531 | 2.487 |
| 4 | 3.902 | 3.808 | 3.717 | 3.630 | 3.546 | 3.465 | 3.387 | 3.312 | 3.240 | 3.170 |
| 5 | 4.853 | 4.713 | 4.580 | 4.452 | 4.329 | 4.212 | 4.100 | 3.993 | 3.890 | 3.791 |
| 6 | 5.795 | 5.601 | 5.417 | 5.242 | 5.076 | 4.917 | 4.767 | 4.623 | 4.486 | 4.355 |
| 7 | 6.728 | 6.472 | 6.230 | 6.002 | 5.786 | 5.582 | 5.389 | 5.206 | 5.033 | 4.868 |
| 8 | 7.652 | 7.325 | 7.020 | 6.733 | 6.463 | 6.210 | 5.971 | 5.747 | 5.535 | 5.335 |
| 9 | 8.566 | 8.162 | 7.786 | 7.435 | 7.108 | 6.802 | 6.515 | 6.247 | 5.995 | 5.759 |
| 10 | 9.471 | 8.983 | 8.530 | 8.111 | 7.722 | 7.360 | 7.024 | 6.710 | 6.418 | 6.145 |
| 11 | 10.368 | 9.787 | 9.253 | 8.760 | 8.306 | 7.887 | 7.499 | 7.139 | 6.805 | 6.495 |
| 12 | 11.255 | 10.575 | 9.954 | 9.385 | 8.863 | 8.384 | 7.943 | 7.536 | 7.161 | 6.814 |
| 13 | 12.134 | 11.348 | 10.635 | 9.986 | 9.394 | 8.853 | 8.358 | 7.904 | 7.487 | 7.103 |
| 14 | 13.004 | 12.106 | 11.296 | 10.563 | 9.899 | 9.295 | 8.745 | 8.244 | 7.786 | 7.367 |
| 15 | 13.865 | 12.849 | 11.938 | 11.118 | 10.380 | 9.712 | 9.108 | 8.559 | 8.061 | 7.606 |
| 16 | 14.718 | 13.578 | 12.561 | 11.652 | 10.838 | 10.106 | 9.447 | 8.851 | 8.313 | 7.824 |
| 17 | 15.562 | 14.292 | 13.166 | 12.166 | 11.274 | 10.477 | 9.763 | 9.122 | 8.544 | 8.022 |
| 18 | 16.398 | 14.992 | 13.754 | 12.659 | 11.690 | 10.828 | 10.059 | 9.372 | 8.756 | 8.201 |
| 19 | 17.226 | 15.679 | 14.324 | 13.134 | 12.085 | 11.158 | 10.336 | 9.604 | 8.950 | 8.365 |
| 20 | 18.046 | 16.351 | 14.878 | 13.590 | 12.462 | 11.470 | 10.594 | 9.818 | 9.129 | 8.514 |


| Periods |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $(n)$ | Interest rates $(r)$ |  |  |  |  |  |  |  |  |  |  | $19 \%$ | $18 \%$ | $20 \%$ |
|  | $11 \%$ | $12 \%$ | $13 \%$ | $14 \%$ | $15 \%$ | $16 \%$ | $17 \%$ | $18 \%$ | $19 \%$ | 0.847 |  |  |  |  |
| 1 | 0.901 | 0.893 | 0.885 | 0.877 | 0.870 | 0.862 | 0.855 | 0.847 | 0.840 | 0.833 |  |  |  |  |
| 2 | 1.713 | 1.690 | 1.668 | 1.647 | 1.626 | 1.605 | 1.585 | 1.566 | 1.547 | 1.528 |  |  |  |  |
| 3 | 2.444 | 2.402 | 2.361 | 2.322 | 2.283 | 2.246 | 2.210 | 2.174 | 2.140 | 2.106 |  |  |  |  |
| 4 | 3.102 | 3.037 | 2.974 | 2.914 | 2.855 | 2.798 | 2.743 | 2.690 | 2.639 | 2.589 |  |  |  |  |
| 5 | 3.696 | 3.605 | 3.517 | 3.433 | 3.352 | 3.274 | 3.199 | 3.127 | 3.058 | 2.991 |  |  |  |  |
| 6 | 4.231 | 4.111 | 3.998 | 3.889 | 3.784 | 3.685 | 3.589 | 3.498 | 3.410 | 3.326 |  |  |  |  |
| 7 | 4.712 | 4.564 | 4.423 | 4.288 | 4.160 | 4.039 | 3.922 | 3.812 | 3.706 | 3.605 |  |  |  |  |
| 8 | 5.146 | 4.968 | 4.799 | 4.639 | 4.487 | 4.344 | 4.207 | 4.078 | 3.954 | 3.837 |  |  |  |  |
| 9 | 5.537 | 5.328 | 5.132 | 4.946 | 4.772 | 4.607 | 4.451 | 4.303 | 4.163 | 4.031 |  |  |  |  |
| 10 | 5.889 | 5.650 | 5.426 | 5.216 | 5.019 | 4.833 | 4.659 | 4.494 | 4.339 | 4.192 |  |  |  |  |
| 11 | 6.207 | 5.938 | 5.687 | 5.453 | 5.234 | 5.029 | 4.836 | 4.656 | 4.486 | 4.327 |  |  |  |  |
| 12 | 6.492 | 6.194 | 5.918 | 5.660 | 5.421 | 5.197 | 4.988 | 4.793 | 4.611 | 4.439 |  |  |  |  |
| 13 | 6.750 | 6.424 | 6.122 | 5.842 | 5.583 | 5.342 | 5.118 | 4.910 | 4.715 | 4.533 |  |  |  |  |
| 14 | 6.982 | 6.628 | 6.302 | 6.002 | 5.724 | 5.468 | 5.229 | 5.008 | 4.802 | 4.611 |  |  |  |  |
| 15 | 7.191 | 6.811 | 6.462 | 6.142 | 5.847 | 5.575 | 5.324 | 5.092 | 4.876 | 4.675 |  |  |  |  |
| 16 | 7.379 | 6.974 | 6.604 | 6.265 | 5.954 | 5.668 | 5.405 | 5.162 | 4.938 | 4.730 |  |  |  |  |
| 17 | 7.549 | 7.120 | 6.729 | 6.373 | 6.047 | 5.749 | 5.475 | 5.222 | 4.990 | 4.775 |  |  |  |  |
| 18 | 7.702 | 7.250 | 6.840 | 6.467 | 6.128 | 5.818 | 5.534 | 5.273 | 5.033 | 4.812 |  |  |  |  |
| 19 | 7.839 | 7.366 | 6.938 | 6.550 | 6.198 | 5.877 | 5.584 | 5.316 | 5.070 | 4.843 |  |  |  |  |
| 20 | 7.963 | 7.469 | 7.025 | 6.623 | 6.259 | 5.929 | 5.628 | 5.353 | 5.101 | 4.870 |  |  |  |  |

## PROBABILITY

$A \cup B=A$ or $B$.
$A \cap B=A$ and $B$ (overlap).
$P(B \mid A)=$ probability of $B$, given $A$.

## Rules of Addition

If $A$ and $B$ are mutually exclusive:
If $A$ and $B$ are not mutually exclusive:

$$
\begin{aligned}
& P(A \cup B)=P(A)+P(B) \\
& P(A \cup B)=P(A)+P(B)-P(A \cap B)
\end{aligned}
$$

## Rules of Multiplication

If $A$ and $B$ are independent:

$$
\begin{aligned}
& P(A \cap B)=P(A) * P(B) \\
& P(A \cap B)=P(A) * P(B \mid A)
\end{aligned}
$$

If $A$ and $B$ are not independent:
$E(X)=\sum$ (probability * payoff)

## DESCRIPTIVE STATISTICS

Arithmetic Mean

$$
\bar{x}=\frac{\sum x}{n} \quad \bar{x}=\frac{\sum f x}{\sum f} \quad \text { (frequency distribution) }
$$

## Standard Deviation

$$
S D=\sqrt{\frac{\sum(x-\bar{x})^{2}}{n}} \quad S D=\sqrt{\frac{\sum \mathrm{fx}^{2}-\overline{\mathrm{x}^{2}}}{\sum \mathrm{f}}} \text { (frequency distribution) }
$$

## INDEX NUMBERS

Price relative $=100 * P_{1} / P_{0} \quad$ Quantity relative $=100 * Q_{1} / Q_{0}$
Price: $\quad \frac{\sum w *\left(\frac{P_{1}}{P_{0}}\right)}{\sum w} \times 100$
Quantity: $\quad \frac{\sum w *\left(\frac{Q_{1}}{Q_{0}}\right)}{\sum w} \times 100$

## TIME SERIES

Additive Model
Series = Trend + Seasonal + Random

Multiplicative Model

$$
\text { Series }=\text { Trend * Seasonal * Random }
$$

## FINANCIAL MATHEMATICS

## Compound Interest (Values and Sums)

Future Value $S$, of a sum of $X$, invested for $n$ periods, compounded at $r \%$ interest

$$
S=X[1+r]^{n}
$$

## Annuity

Present value of an annuity of $£ 1$ per annum receivable or payable for $n$ years, commencing in one year, discounted at $r \%$ per annum:

$$
\mathrm{PV}=\frac{1}{r}\left[1-\frac{1}{[1+r]^{n}}\right]
$$

## Perpetuity

Present value of $£ 1$ per annum, payable or receivable in perpetuity, commencing in one year, discounted at $r \%$ per annum:

$$
\mathrm{PV}=\frac{1}{r}
$$

## LEARNING CURVE

$$
Y_{x}=a x^{b}
$$

where:
$Y_{X}=$ the cumulative average time per unit to produce $X$ units;
$a=$ the time required to produce the first unit of output;
$X=$ the cumulative number of units;
$b=$ the index of learning.
The exponent $b$ is defined as the log of the learning curve improvement rate divided by $\log 2$.

## INVENTORY MANAGEMENT

Economic Order Quantity

$$
\mathrm{EOQ}=\sqrt{\frac{2 \mathrm{C}_{0} \mathrm{D}}{\mathrm{C}_{\mathrm{h}}}}
$$

where: $\mathrm{C}_{0}=$ cost of placing an order
$C_{h}=$ cost of holding one unit in inventory for one year
D $\quad=$ annual demand

## LIST OF VERBS USED IN THE QUESTION REQUIREMENTS

A list of the learning objectives and verbs that appear in the syllabus and in the question requirements for each question in this paper.

It is important that you answer the question according to the definition of the verb.

| LEARNING OBJECTIVE | VERBS USED | DEFINITION |
| :---: | :---: | :---: |
| Level 1 - KNOWLEDGE |  |  |
| What you are expected to know. | List | Make a list of |
|  | State | Express, fully or clearly, the details/facts of |
|  | Define | Give the exact meaning of |
| Level 2 - COMPREHENSION |  |  |
| What you are expected to understand. | Describe | Communicate the key features |
|  | Distinguish | Highlight the differences between |
|  | Explain | Make clear or intelligible/State the meaning or purpose of |
|  | Identify | Recognise, establish or select after consideration |
|  | Illustrate | Use an example to describe or explain something |
| Level 3 - APPLICATION |  |  |
| How you are expected to apply your knowledge. | Apply | Put to practical use |
|  | Calculate | Ascertain or reckon mathematically |
|  | Demonstrate | Prove with certainty or to exhibit by practical means |
|  | Prepare | Make or get ready for use |
|  | Reconcile | Make or prove consistent/compatible |
|  | Solve | Find an answer to |
|  | Tabulate | Arrange in a table |
| Level 4 - ANALYSIS |  |  |
| How are you expected to analyse the detail of what you have learned. | Analyse | Examine in detail the structure of |
|  | Categorise | Place into a defined class or division |
|  | Compare and contrast | Show the similarities and/or differences between |
|  | Construct | Build up or compile |
|  | Discuss | Examine in detail by argument |
|  | Interpret | Translate into intelligible or familiar terms |
|  | Prioritise | Place in order of priority or sequence for action |
|  | Produce | Create or bring into existence |
| Level 5 - EVALUATION |  |  |
| How are you expected to use your learning to evaluate, make decisions or recommendations. | Advise | Counsel, inform or notify |
|  | Evaluate | Appraise or assess the value of |
|  | Recommend | Advise on a course of action |

## Performance Pillar

## Management Level Paper

## P2 - Performance Management

## March 2014

