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| MARK SCHEME | نموذج الإجابة وتوزيع الدرجات |
| KINGDOM OF BAHRAIN | مملكة البحرين |
| NATIONAL AUTHORITY for QUALIFICATIONS and QUALITY ASSURANCE of EDUCATION and TRAINING | الهيئة الوطنية للمؤهلات و ضمان جودة التعليم و التدريب |
| Directorate of National Examinations | إدارة الامتحانات الوطنية |
| Grade 12 National Examinations | الامتحانات الوطنية للصف الثاني عشر |
| March 2016 | مارس 2016 |
| PROBLEM SOLVING | حل المشكلات |
| Paper 2 Problem Analysis and Solution | الورقة 2 تحليل و حل المشكلات |

This mark scheme is published as an aid to teachers and students, to indicate the requirements of the National Examinations. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at the Examiners' meeting before marking began. All Examiners are instructed that alternative correct answers and unexpected approaches in students' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated, even if they do not appear in this mark scheme. Therefore, the Directorate of National Examinations, QQA will not enter into discussions or correspondence in connection with these mark schemes.

Mark schemes must be read in conjunction with the question papers and the Principal Examiner reports.

- 1 (a1) What is the maximum number of times that Hassan can ride on the Flying Carousel in one day? [2]**

47 ($12 \times 4 - 1$)

Award 2 marks.

If 2 marks cannot be awarded, award 1 mark for an answer of 48 or clear recognition that the park is open for 12 hours **and** there are 4 rides every hour.

- (a2) What is the maximum number of times that Hassan can ride on the Flying Carousel when he has only paid 300 fils entrance? [2]**

19 ($5 \times 4 - 1$)

Award 2 marks.

If 2 marks cannot be awarded, award 1 mark for clear recognition that Hassan arrived after 5:00 pm or that Hassan could only be there for 5 hours.

- (b) On a busy day, what is the maximum total number of people that can ride on the Rotating Star in one day? [2]**

1880 (47×40)

Accept: an incorrect answer to (a1) correctly multiplied by 40.

Award 2 marks.

If 2 marks cannot be awarded, award 1 mark for extraction of capacity of 40 for the Rotating Star.

- (c) **What is the greatest amount that Qasim might have to spend in total to ride with his children without repeating any of the rides?** [4]

BD 13.500 ($0.9 + 2.8 + 1.4 \times 7$)

Award 4 marks.

If 4 marks cannot be awarded, award 3 marks for an answer of BD 12.600 or working that shows the total cost of the rides to be BD 12.600.

If 3 marks cannot be awarded, award 2 marks for recognition that the maximum number of rides is 8 **and** one of the rides must be the Monorail.

If 2 marks cannot be awarded, award 1 mark for **either** of the following:

- Total entrance cost is 900 fils / BD 0.900.
- Recognition that the maximum number of rides is 8.

- (d1) **How many rides did Mohammed go on?** [1]

7 rides ($6 \times 500 + 750 + 500 = 4250$ fils = BD 4.250)

Award 1 mark.

- (d2) **Explain whether he was able to go on his favourite ride, the Tornado, or not.** [1]

Award 1 mark for an answer that indicates that he had 1000 fils spare after 6 rides at 500 fils each.

- (e) **What is the latest time that they must get to the Flying Carousel by for the Majic Passes to be more economical than paying for each ride?** [3]

3:30 (pm)

Award 3 marks.

If 3 marks cannot be awarded, award 2 marks for clear recognition at least four of the following:

- The Majic Passes will cost a total of BD 40.
- Each ride will cost a total of BD 1.500.
- $40 \div 1.5 = 26.67$.
- Entrance cost is a total of BD 1.500.
- They need to go on 26 rides.

If 2 marks cannot be awarded, award 1 mark for clear recognition for three of the above listed.

- 2 (a1) What is the premium that Ahmed will pay to insure his car with the Hope insurance company for the first year? [1]**

BD 200 (10000×0.02)

Award 1 mark.

- (a2) What premium will Ahmed pay when he renews the insurance with the Hope company after one year, providing he does not have an accident? [2]**

BD 168 ($0.02 \times 0.84 \times \text{BD } 10000$)

Award 2 marks.

If 2 marks cannot be awarded, award 1 mark for showing that after one year the car will be worth BD 8400.

- (b) In the event of Ahmed having an accident during the first year, would the Cooperation company have been a better option than the Hope company as his choice of insurance company? Explain your answer. [3]

With the Cooperation company, next year the car would be worth $0.85 \times 10000 = \text{BD } 8500$. Thus the premium for next year would be: $\text{BD } 8500 \times 0.03 \times 1.30 = \text{BD } 331.500$.

With the Hope company, next year the car will be worth $0.84 \times \text{BD } 10000 = \text{BD } 8400$, so its premium will be: $\text{BD } 8400 \times 0.02 \times 1.60 = \text{BD } 268.800$.

Therefore, insuring the car with the Hope company is still a better option, even after an accident.

- Award 1 mark for finding the premium after the accident with the Cooperation Company as $\text{BD } 331.500$.
- Award 1 mark for finding the premium after the accident with the Hope Company as $\text{BD } 268.800$.

If 2 marks have been awarded as stated above, then award 1 further mark for stating that the Hope company is (still) a better choice for insurance, (even) after an accident.

Special case: accept a student's incorrect answer to (a2) + 60%, correctly calculated, and then a decision based on this amount.

If 3 marks cannot be awarded, award 2 marks for using $\text{BD } 10000$ and finding the premium after the accident with the Cooperation Company as $\text{BD } 390$ **and** the premium after the accident with the Hope Company as $\text{BD } 320$, **and** then a correct decision based on that.

If 2 marks cannot be awarded, award 1 mark for using $\text{BD } 10000$ and finding the premium after the accident with the Cooperation Company as $\text{BD } 390$ **and** the premium after the accident with the Hope Company as $\text{BD } 320$ or for sight of $\text{BD } 8500$ **and** $\text{BD } 8400$.

(c1) What is the Integrity company's annual depreciation rate? [4]

15%

Award 4 marks.

If 4 marks cannot be awarded, award 3 marks for recognition that the car would have a value of BD 8500 after one year ($BD\ 204 \div 0.024$; or a search can be carried out, leading to 2.4% of $BD\ 8500 = BD\ 204$).

If 3 marks cannot be awarded, award 2 marks for recognition that the premium with the Integrity company would be:
 $BD\ 204 (BD\ 215 - BD\ 11)$.

If 2 marks cannot be awarded, award 1 mark for recognition that the premium with the Leadership company would be:
 $BD\ 215 (0.025 \times 0.86 \times BD\ 10000)$.

(c2) What is the Integrity company's accident increment rate? [2]

50% ($BD\ (306 - 204) / BD\ 204 \times 100\%$)

Award 2 marks.

If 2 marks cannot be awarded, award 1 mark for recognition that the premium with the Integrity company would be:
 $BD\ 306 (BD\ 215 \times 1.4 + BD\ 5)$.

Accept correctly calculated answers, using incorrect values calculated for either or both of the premiums without an accident in (c1).

(d) What is the greatest number of his vehicles that Khalid can insure under comprehensive cover? Justify your answer. [3]

Each car costs BD 180 and each truck costs BD 400 to insure under comprehensive cover.

Insuring 3 cars and 3 trucks under comprehensive cover would cost BD 1740 + BD 80 for third party cover for the other truck = a total of BD 1820.

Insuring 2 cars and 4 trucks under comprehensive cover would cost BD 1960 + BD 40 for third party cover for the other car = a total of BD 2000.

Insuring 3 cars and 2 trucks under comprehensive cover would cost BD 1340 + BD 160 for third party cover for the other two trucks = a total of BD 1500.

Insuring 2 cars and 3 trucks under comprehensive cover would cost BD 1560 + BD 120 for third party cover for the two vehicles = a total of BD 1680.

Insuring 1 cars and 4 trucks under comprehensive cover would cost BD 1780 + BD 80 for third party cover for the other two cars = a total of BD 1860.

Award 1 mark for each of the following:

- An answer of 5.
- A clear demonstration that the total cost when 6 of the vehicles are insured under comprehensive cover exceeds BD 1750.
- A clear demonstration that 5 of the vehicles can be insured under comprehensive cover for a total cost of either BD 1500 or BD 1680.

3 (a) How much in total did it cost the family to attend the Grand Prix? [3]

\$2604 ($3 \times 68 + 5 \times 320 + 2 \times 400$)

Award 3 marks.

If 3 marks cannot be awarded, award 1 mark for recognition of each of the following (maximum 2 marks):

- Cost of student tickets is \$68.
- 5 of “Early Bird” tickets were bought for \$320 each.
- 2 tickets were bought for \$400 each.

(b) All the “Early Bird” and student tickets were sold very quickly. How much potential income was lost from the sale of these tickets? [4]

\$72080

Award 4 marks.

If 4 marks cannot be awarded, award 3 marks for \$44480, which forgets to include student tickets or for mentioning that the full price for all tickets is \$317950 **and** the discount price for all tickets is \$245870.

If 3 marks cannot be awarded, award 1 mark each for any of the following (maximum 2 marks):

- $200 \times \$80 = \16000
- $220 \times \$48 = \10560
- $250 \times \$40 = \10000
- $165 \times \$24 = \3960
- $300 \times \$92 = \27600

Or award 2 marks for mentioning one of the following:

- the full price for all tickets is \$317950
- the discount price for all tickets is \$245870
- the full price for early bird tickets is \$269950 **and** the discount price for early bird tickets is \$225470.

If 2 marks cannot be awarded, award 1 mark for mentioning that the full price for early bird tickets is \$269950 **or** the discount price for early bird tickets is \$225470.

- (c) **What was the percentage by which the student tickets were reduced from the full price?** [2]

57.5% ($92 \div 160 \times 100\%$)

Award 2 marks.

If 2 marks cannot be awarded, award 1 mark for **either** recognition that the reduction is \$92, **or** an answer of 42.5% ($68 \div 160 \times 100\%$).

- (d) **How many tickets did it buy for the Batelco Grandstand?** [2]

6 ($6 \times \$320 + 3 \times \$400 + 11 \times \$267 = \6057)

Award 2 marks.

If 2 marks cannot be awarded, award 1 mark for sight of a search that includes at least one of the following correct calculations:

- $2 \times \$320 + 1 \times \$400 + 17 \times \$267 = \5579
- $4 \times \$320 + 2 \times \$400 + 14 \times \$267 = \5818
- $8 \times \$320 + 4 \times \$400 + 8 \times \$267 = \6296
- $10 \times \$320 + 5 \times \$400 + 5 \times \$267 = \6535
- $12 \times \$320 + 6 \times \$400 + 2 \times \$267 = \6774

Or award 1 mark for setting the equation:

$$320 (2x) + 400 (x) + 267 (20 - 3x) = 6057$$

- (e) **How many tickets for each grandstand did it buy?** [3]
2 Main Grandstand tickets and 3 Batelco Grandstand tickets
Award 3 marks.

(Solve the system of equations $400x + 320y = 1760$ and $320x + 272y = 1456$)

If 3 marks cannot be awarded, award 2 marks for each of the following:

- Setting the equation of the difference $80x + 48y = 304$
- Setting the equation of the regular cost $400x + 320y = 1760$ **and** the equation of the discounted cost $320x + 272y = 1456$

If 2 marks cannot be awarded, award 1 mark for each of the following:

- Setting the equation of the regular cost $400x + 320y = 1760$
- Setting the equation of the discounted cost $320x + 272y = 1456$
- for sight of a search that includes correct calculation for the difference equation. For example: $80 \times 2 + 48 \times 2 = 256$
- for sight of a search that includes correct calculation for the regular cost and the discounted cost equations. For example: $400 \times 2 + 320 \times 2 = 1440$ and $320 \times 2 + 272 \times 2 = 1184$

- (f) **How many tickets were given away free?** [3]
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Award 3 marks.

(1677, 1688, 1699, 2577, 2588, 2599, 3666, 3677, 3688, 3699, 4944, 4955, 4966, 4977, 4988, 4999)

If 3 marks cannot be awarded, award 2 marks for at least 12 of the above numbers seen **and** no more than 1 incorrect number.

If 2 marks cannot be awarded, award 1 mark for at least 10 of the above numbers seen **and** no more than 2 incorrect numbers **or** mentioning 25 tickets (forgetting that tickets are up to 5000).

- (g) **Give the cost of each one of the six tickets.** [3]
\$400, \$400, \$272, \$272, \$267, \$227
Award 3 marks.

If 3 marks cannot be awarded, award 2 marks for clear recognition that the student understands that the average cost of the tickets is \$306.33 / greater than \$300, so at least 2 tickets must cost \$320 or \$400 each **and** makes a correct calculation that buys 2 tickets for 3 different Grandstands.

For example:

$$\$400 + \$320 + \$267 + \$267 + \$136 + \$136 = \$1526$$

If 2 marks cannot be awarded, award 1 marks for clear recognition that the student understands that the average cost of the tickets is \$306.33 / greater than \$300, so at least 2 tickets must cost \$320 or \$400 each **or** any correct calculation that buys 2 tickets for 3 different grandstands.