QUESTION 7 (50 MARKS)

Question 7 (a)

Ticket price: €20, attendance: 12 000
Ticket price: €19, attendance: 13 000
Ticket price: €18, attendance: 14 000
ANSWER: 14 000 people

Question 7 (b)

Call y the number in the stadium.

$y = 12\,000$ when $x = €20$
$y = 13\,000$ when $x = €19$
$y = 14\,000$ when $x = €18$
$y = 15\,000$ when $x = €17$

$$\begin{aligned} y &= 12\,000 + (20 - x)1000 \\ &= 12\,000 + 20\,000 - 1000x \\ &= 32\,000 - 1000x \end{aligned}$$

Question 7 (c)

$$\begin{aligned} f(x) &= \text{Number who attended} \times \text{Price} \\ &= y \times x \\ &= (32\,000 - 1000x)x \\ &= 32\,000x - 1000x^2 \end{aligned}$$

MARKING SCHEME NOTES

Question 7 (a) [Scale 10B (0, 5, 10)]

5: • $(20–18)1000$ or equivalent

Question 7 (b) [Scale 5B (0, 2, 5)]

2: • Expression $(20 - x)$
NOTE: Accept for 5 marks $12000 + (20 - x)1000$ or equivalent

Question 7 (c) [Scale 5B (0, 2, 5)]

2: • Correct number of people and/or correct rate in terms of x

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Question 7 (d)

Differentiate the function with respect to x. Put the derivative equal to zero and solve for x to find the price that will give the maximum income.

$f(x) = 32\,000x - 1000x^2$

$f'(x) = 32\,000 - 2000x$

$f'(x) = 0 \Rightarrow 32\,000 - 2000x = 0$

$32\,000 = 2000x$

$\therefore x = \dfrac{32\,000}{2000} = €16$

> Find turning points (local maxiumum/minimum)
> Put $\dfrac{dy}{dx} = 0$ and solve for x

Marking Scheme Notes

Question 7 (d) [Scale 10B (0, 5, 10)]

5:
- Some correct differentiation of a quadratic function
- $(32000 - 2000x) = 0$ or equivalent
- Correct testing with incorrect deduction or no deduction
- Possible to get full marks without use of calculus
- Correct answer and no work

Question 7 (e)

$x = €16$

$f(x) = 32\,000x - 1000x^2$

$f(16) = 32\,000(16) - 1000(16)^2 = €256\,000$

Question 7 (f)

Find out the price of a ticket x that gives a full attendance of $y = 25\,000$.

$y = 25\,000$

$y = 32\,000 - 1000x$

$25\,000 = 32\,000 - 1000x$

$1000x = 7000$

$\therefore x = €7$

$x = €7$

$f(x) = 32\,000x - 1000x^2$

$f(7) = 32\,000(7) - 1000(7)^2 = €175\,000$

Difference = €256 000 – €175 000 = €81 000

Marking Scheme Notes

Question 7 (e) [Scale 5B (0, 2, 5)]

2:
- Some effort at substitution of 16 or equivalent

Question 7 (f) [Scale 10C (0, 3, 7, 10)]

3:
- Use of expression
- Use of 25 000
- Some use of tables
- Equation solved
- Price of ticket found

7:
- Total income from sales

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Question 7 (g)

Call p the price of a family ticket.
If 1000 more family tickets are sold, then 4000 less single tickets will be sold. The loss overall will be €14 000.

$\therefore 1000p - 4000 \times 16 = -14\,000$

$1000p = 4000 \times 16 - 14\,000$

$1000p = 50\,000$

$\therefore p = €50$

Let a = Number of single tickets
Let b = Number of family tickets
Attendance equation: $a + 4b = 25\,000$...(**1**)
Income equation: $16a + 50b = 365\,000$...(**2**)

Solve equations (**1**) and (**2**):

$a + 4b = 25\,000$.....(**1**)$(\times 16)$

$16a + 50b = 365\,000$....(**2**)$(\times -1)$

$$16a + 64b = 400\,000$$
$$-16a - 50b = -365\,000$$
$$14b = 35\,000 \Rightarrow b = \frac{35\,000}{14} = 2500$$

Answer: 2500 family tickets

Marking Scheme Notes
Question 7 (g) [Scale 5D (0, 2, 3, 4, 5)]
2: • Correct number of family tickets
• One equation only
• Income from single tickets
• Income from family tickets
3: • Two correct linear equations for income in two unknowns
• $y = 50$ without work, or $p = 15\,000$ without work
4: • Correct value for p (single ticket)
• Correct value for y (family ticket)
OR
Question 7 (g) [Scale 5D (0, 2, 3, 4, 5)]
2: • One correct equation
3: • Three correct equations
4: • One unknown calculated

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