4.5 Inequalities: Test Pack

EDEXCEL 1MA1 · Calculator allowed · about 60 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Write down the inequality that shows x is less than 7.

(Total for Question 1 is 1 mark)

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2 Work out the integer values of n that satisfy $n < 3$ and $n \geq -1$. List all integers that satisfy both inequalities.

(Total for Question 2 is 3 marks)

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3 A shop sells a small bag of sweets for p pounds. The price must be at most £2.50. Write an inequality for p, then state whether $p = 2.50$ is allowed.

(a) Write an inequality that describes the allowed prices p. **(2)**

(b) Is $p = 2.50$ allowed? State yes or no and give a brief reason. **(2)**

(Total for Question 3 is 4 marks)

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4 Solve $3n + 4 \geq 6n + 4$

(Total for Question 4 is 3 marks)

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5 A playground has a rule: children may play only if their height h in metres satisfies $1.2 < h \leq 1.6$.

(a) Which of these children are allowed to play? Alice is 1.2 m, Jamal is 1.45 m, Priya is 1.6 m, Yusuf is 1.61 m. **(2)**

(b) Write the inequality for allowed heights h. **(2)**

.....

(c) Find the smallest whole number of centimetres greater than 1.2 m that is allowed. Give your answer in centimetres. **(4)**

.....

(Total for Question 5 is 8 marks)

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6 Solve the inequality $4 + 2x \geq 10$. Show your steps and give the final inequality.

(Total for Question 6 is 4 marks)

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7 Priya has two machines. Machine A produces between 20 and 35 items per hour inclusive. Machine B produces at least 15 items per hour but fewer than 28 items per hour.
Let a be the rate of A and b be the rate of B. Write inequalities for a and b, then find the range of possible values for a + b. Give your answer as an inequality.

(Total for Question 7 is 6 marks)

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8 Show that for all real x, if $2x - 3 < 7$ then $x < 5$. Then determine whether the converse statement is true: "If $x < 5$ then $2x - 3 < 7$". Give a brief justification for your answer.

(Total for Question 8 is 9 marks)

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9 The inequality $2x^2 - 7x - 15 < 0$ is given.

(a) Show that $2x^2 - 7x - 15 = (2x + 3)(x - 5)$ and hence solve $2x^2 - 7x - 15 < 0$, giving your answer in inequality form. **(3)**

(b) Hence, or otherwise, find how many integer values of x satisfy $2x^2 - 7x - 15 < 0$. Explain your reasoning clearly. **(5)**

(Total for Question 9 is 8 marks)

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Mark scheme · 4.5 Inequalities: Test Pack

Question 1

x < 7 cao **B1**

Answer: x < 7

Question 2

identify integer range -1, 0, 1, 2 or show method **M1**

list: -1, 0, 1, 2 cao **A1**

states correctly that 3 is not included (ft) or shows x < 3 not x ≤ 3 **B1**

Answer: -1, 0, 1, 2

Question 3

(a) set up p ≤ 2.50 or p ≤ 2.5 **M1**

(a) p ≤ 2.5 cao **A1**

(a) Answer: p ≤ 2.5

(b) Yes, because p ≤ 2.5 allows p = 2.5 **B1**

(b) reason stated or equivalent explanation **B1**

(b) Answer: Yes. Because p ≤ 2.5 includes p = 2.5.

Question 4

collects the letter terms on one side **M1**

collects the numbers on the other side **M1**

n ≤ 0 **A1**

Answer: n ≤ 0

Question 5

(a) Jamal and Priya identified as allowed **B1**

(a) Alice and Yusuf identified as not allowed (Alice is exactly 1.2, Yusuf > 1.6) **B1**

(a) Answer: Jamal and Priya are allowed; Alice and Yusuf are not.

(b) use correct inequality with strict lower bound and inclusive upper bound **M1**

(b) 1.2 < h ≤ 1.6 cao **A1**

(b) Answer: 1.2 < h ≤ 1.6

(c) convert 1.2 m to 120 cm and consider strictly greater, so next whole cm is 121 cm **M1**

(c) check 121 cm = 1.21 m ≤ 1.6 m **M1**

(c) 121 cm cao **A1**

(c) explicit statement smallest whole number of cm is 121 **B1**

(c) Answer: 121 cm

Question 6

subtract 4 from both sides to get 2x ≥ 6 **M1**

divide both sides by 2 to get x ≥ 3 **M1**

x ≥ 3 cao **A1**

correct check or statement that x = 3 satisfies 4 + 2x ≥ 10 **B1**

Answer: x ≥ 3

Question 7

write inequalities: 20 ≤ a ≤ 35 and 15 ≤ b < 28 (method) **M1**

find minimum a + b by adding minima: 20 + 15 = 35 (method) **M1**

find maximum a + b by adding maxima as a bound: 35 + 28 = 63 (method) **M1**

note the strictness from b < 28 makes the upper bound strict so a + b < 63 (method) **M1**

state final inequality 35 ≤ a + b < 63 cao **A1**

reason that endpoints 35 and 63 follow from inclusive and exclusive bounds respectively oe **B1**

Answer: 35 ≤ a + b < 63

Question 8

add 3 to both sides of 2x - 3 < 7 to get 2x < 10 (method) **M1**

divide both sides by 2 (positive) to give x < 5 (method) **M1**

conclude x < 5 for the first part cao **A1**

state that the converse must be tested: assume x < 5 (method) **M1**

multiply the assumed inequality by 2 to get 2x < 10 (method) **M1**

subtract 3 to get 2x - 3 < 7 (method) **M1**

conclude the converse is true: if x < 5 then 2x - 3 < 7 cao **A1**

state the reason concisely: multiplication by a positive number and subtraction preserve strict inequality oe **B1**

explicitly note domain is all real x so no hidden exceptions oe **B1**

Answer: First part: x < 5. Converse: true. Reason: assuming x < 5, multiply by 2 to obtain 2x < 10 then subtract 3 to get 2x - 3 < 7; operations preserve the strict inequality because 2 > 0.

Question 9

(a) correct factorisation shown: (2x + 3)(x - 5) (method) **M1**

(a) identify roots x = -3/2 and x = 5 from factors (method) **M1**

(a) solution: -3/2 < x < 5 cao **A1**

(a) Answer: -3/2 < x < 5

(b) use result from part (a): -3/2 < x < 5 (follow through) **M1**

(b) identify integers strictly greater than -1.5 and strictly less than 5: -1, 0, 1, 2, 3, 4 (method) **M1**

(b) count the listed integers correctly (method) **M1**

(b) state final answer 6 integers cao **A1**

(b) justify endpoints excluded because inequality is strict so x = -3/2 and x = 5 are not allowed oe **B1**

(b) Answer: There are 6 integer solutions: x = -1, 0, 1, 2, 3, 4.

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