1.2 Pure: Algebra and Functions: Test Pack

EDEXCEL 9MA0 · Calculator allowed · about 60 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Show all algebraic working; do not use a calculator to evaluate surd expressions.

(a) Simplify fully $(8x^9)^{2/3}$. **(2)**

(b) Show that $(3\sqrt{5} - 2)(3\sqrt{5} + 2) = 41$. **(2)**

(c) Express $10/(\sqrt{5} - 2)$ in the form $a + b*\sqrt{5}$, where a and b are integers. **(3)**

(Total for Question 1 is 7 marks)

---

2 Factorise $x^2 - 64$.

(Total for Question 2 is 1 mark)

---

3 $f(x) = x^2 - 8x + 19$.

(a) Express f(x) in the form $(x - p)^2 + q$, stating the values of p and q. **(2)**

(b) State the minimum value of f(x) and the value of x at which it occurs. **(2)**

(c) Show that the equation $f(x) = 2$ has no real roots. **(3)**

(Total for Question 3 is 7 marks)

---

4 Write $27^{2/3}$ as an integer.

(Total for Question 4 is 1 mark)

---

5 Solve the following inequalities.

(a) Solve the inequality $2x^2 - 5x - 3 \leq 0$. **(3)**

(b) Solve the inequality $|2x - 3| < 3$. **(3)**

(c) Hence find the set of values of x for which both $2x^2 - 5x - 3 \leq 0$ and $|2x - 3| < 3$ are satisfied. **(2)**

(Total for Question 5 is 8 marks)

---

6 $f(x) = 3x - 8$. Find $f^{-1}(x)$.

(Total for Question 6 is 2 marks)

© Revision Library | revisionlibrary.co.uk

7 The line l has equation $y = -2x - 5$ and the curve C has equation $y = x^2 + 3x - 1$. The line meets the curve at the points A and B.

(a) Show that the x coordinates of A and B satisfy $x^2 + 5x + 4 = 0$. **(2)**

(b) Hence find the coordinates of A and B. **(3)**

(c) Find the exact length of AB. **(3)**

(Total for Question 7 is 8 marks)

---

8 Answer the following questions on surds.

(a) Express $(2 - 3\sqrt{6})/(5 - \sqrt{6})$ in the form $a + b\sqrt{6}$, where a and b are rational numbers. **(4)**

(b) Simplify $\sqrt{216} + \sqrt{24} - \sqrt{6}$, giving your answer in the form $k\sqrt{6}$. **(2)**

(Total for Question 8 is 6 marks)

---

9 The function f is defined by $f(x) = (4x + 3)/(x - 4)$, x is real, x not equal to 4. Show that f is a self-inverse function, and hence write down the value of ff(6).

(Total for Question 9 is 4 marks)

---

10 Prove that $x^2 - 10x + 30 > 0$ for all real values of x, and state the minimum value of the expression and the value of x at which it occurs.

(Total for Question 10 is 4 marks)

© Revision Library | revisionlibrary.co.uk

Mark scheme · 1.2 Pure: Algebra and Functions: Test Pack

Question 1

(a) $8^{2/3}$ evaluated as 4, or x^9 raised to power 2/3 giving x^6 **M1**

(a) $4x^6$ cao **A1**

(a) Answer: $4x^6$

(b) uses difference of two squares to write $(3\sqrt{5})^2 - 2^2$ **M1**

(b) 45 - 4 = 41 cso, answer printed **A1**

(b) Answer: 41 (shown)

(c) multiplies numerator and denominator by $(\sqrt{5} + 2)$ **M1**

(c) correct denominator 5 - 4 = 1 and expands numerator $10(\sqrt{5} + 2)$ **M1**

(c) $20 + 10\sqrt{5}$ oe, i.e. a = 20, b = 10 cao **A1**

(c) Answer: $20 + 10\sqrt{5}$ (a = 20, b = 10)

Question 2

(x - 8)(x + 8) cao **B1**

Answer: (x - 8)(x + 8)

Question 3

(a) attempt to complete the square, $(x - 4)^2 + k$ **M1**

(a) $(x - 4)^2 + 3$, i.e. p = 4, q = 3 cao **A1**

(a) Answer: $(x - 4)^2 + 3$

(b) minimum value = 3 (ft from part a) **B1ft**

(b) occurs at x = 4 (ft from part a) **B1ft**

(b) Answer: minimum value 3 at x = 4

(c) rearranges to $x^2 - 8x + 17 = 0$ **M1**

(c) attempts discriminant $b^2 - 4ac$ with correct values **M1**

(c) discriminant = -4 < 0 so no real roots, cso **A1**

(c) Answer: discriminant = -4, no real roots (shown)

Question 4

9 cao **B1**

Answer: 9

Question 5

(a) factorises $2x^2-5x-3$ as (2x+1)(x-3) **M1**

(a) critical values x = -1/2 and x = 3 **A1**

(a) $-1/2 \le x \le 3$ cao, correct inequality direction **A1**

(a) Answer: $-0.5 \le x \le 3$

(b) sets up compound inequality $-3 < 2x - 3 < 3$ (or two linear cases) **M1**

(b) critical values x = 0 and x = 3 **A1**

(b) $0 < x < 3$ cao **A1**

(b) Answer: $0 < x < 3$

(c) identifies the need to intersect the two sets from parts (a) and (b) **B1**

(c) $0 < x < 3$ cao (the tighter set) **A1**

(c) Answer: $0 < x < 3$

Question 6

sets y = 3x - 8 and rearranges to make x the subject **M1**

$f^{-1}(x) = (x + 8)/3$ cao **A1**

Answer: $f^{-1}(x) = (x + 8)/3$

Question 7

(a) equates the two expressions for y **M1**

(a) rearranges to $x^2 + 5x + 4 = 0$ (cso) **A1**

(a) Answer: $x^2 + 5x + 4 = 0$

(b) solves the quadratic by factorising or the formula **M1**

(b) x = -4 and x = -1 **A1**

(b) y values 3 and -3, giving (-4, 3) and (-1, -3) **A1**

(b) Answer: A(-4, 3), B(-1, -3)

(c) uses the distance formula **M1**

(c) $AB^2 = 9 + 36 = 45$ **M1**

(c) $AB = 3\sqrt{5}$ **A1**

(c) Answer: $AB = 3\sqrt{5}$

Question 8

(a) multiplies numerator and denominator by the conjugate $5 + \sqrt{6}$ **M1**

(a) denominator 25 - 6 = 19 **A1**

(a) numerator $-8 - 13\sqrt{6}$ **A1**

(a) $-8/19 - (13/19)\sqrt{6}$ **A1**

(a) Answer: $-8/19 - (13/19)\sqrt{6}$

(b) $\sqrt{216} = 6\sqrt{6}$ or $\sqrt{24} = 2\sqrt{6}$ **M1**

(b) $7\sqrt{6}$ **A1**

(b) Answer: $7\sqrt{6}$

Question 9

sets y = (4x+3)/(x-4) and cross-multiplies: y(x-4) = 4x+3 **M1**

collects x terms on one side: x(y-4) = 4y+3 **M1**

$f^{-1}(x) = (4x+3)/(x-4)$, identical to f(x), so f is self-inverse, cso **A1**

ff(6) = 6, using the self-inverse property (ft from part shown) **B1ft**

Answer: f is self-inverse (shown); ff(6) = 6

Question 10

completes the square: $(x - 5)^2 + k$ **M1**

correct completed square $(x - 5)^2 + 5$ **A1**

valid conclusion: $(x-5)^2 \ge 0$ for all real x, so the expression $\ge 5 > 0$, cso **A1**

minimum value 5, occurring at x = 5 **B1**

Answer: $x^2 - 10x + 30 = (x-5)^2 + 5 \ge 5 > 0$ (proved); minimum value 5 at x = 5

© Revision Library | revisionlibrary.co.uk