5.10 Drawing Other Graphs: Cubic/Reciprocal: Test Pack

EDEXCEL 1MA1 · Calculator allowed · about 60 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Work out the value of y when $y = x^3$ and $x = 2$.

(Total for Question 1 is 1 mark)

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2 Complete the table for $y = x^3$. Give values for the missing entries.

(a) $x = -2$, $y =$ _____ **(1)**

(b) $x = 1$, $y =$ _____ **(1)**

(Total for Question 2 is 2 marks)

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3 For each equation below, state whether its graph is linear, quadratic, cubic or reciprocal.

(a) $y = 4x - 3$ **(1)**

- ☐ A) Linear
- ☐ B) Quadratic
- ☐ C) Cubic
- ☐ D) Reciprocal

(b) $y = x^2 + 5$ **(1)**

- ☐ A) Linear
- ☐ B) Quadratic
- ☐ C) Cubic
- ☐ D) Reciprocal

(c) $y = x^3 - 6x$ **(1)**

- ☐ A) Linear
- ☐ B) Quadratic
- ☐ C) Cubic
- ☐ D) Reciprocal

(d) $y = 10/x$ **(1)**

- ☐ A) Linear
- ☐ B) Quadratic
- ☐ C) Cubic
- ☐ D) Reciprocal

(Total for Question 3 is 4 marks)

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4 The graph of $y = x^3 + 2$ is a translation of the graph $y = x^3$.

(a) Describe the translation. **(1)**

(b) Write down the y-intercept of $y = x^3 + 2$. **(1)**

(Total for Question 4 is 2 marks)

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5 A cubic graph has the equation $y = x^3 + 2$.

(a) Write down the coordinates of the y-intercept of the graph. **(1)**

.....

(b) State whether the value of y increases throughout as x increases, giving a reason. **(1)**

(c) Describe the single transformation that maps the graph of $y = x^3$ onto the graph of $y = x^3 + 2$. **(1)**

.....

(Total for Question 5 is 3 marks)

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6 A cubic graph has the equation $y = (x - 1)(x + 3)(x - 2)$.

(a) Find the three x-coordinates of the points where the graph crosses the x-axis. **(2)**

.....

(b) Find the coordinates of the point where the graph crosses the y-axis. **(2)**

.....

(Total for Question 6 is 4 marks)

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7 A reciprocal graph has the equation $y = 2/x + 3$.

(a) State the equation of the horizontal asymptote of the graph. **(1)**

(b) State the equation of the vertical asymptote of the graph. **(1)**

(c) Find the exact coordinates of the point where the graph crosses the x-axis. **(2)**

.....

(Total for Question 7 is 4 marks)

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8 The curve C has equation $y = (x - 2)^3 + 1$.
State the translation that maps $y = x^3$ to the curve C. Hence find the coordinates of the point on C that corresponds to $x = 2$ on $y = x^3$.

(a) State the translation. **(1)**

(b) Find the coordinates of the point on C that corresponds to the point (2, 8) on $y = x^3$. **(2)**

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(Total for Question 8 is 3 marks)

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9 Show that the equation $x^3 - 3x - 6 = 0$ has a solution between $x = 2$ and $x = 3$.

(Total for Question 9 is 3 marks)

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10 The graph of $y = 6/x$ is a reciprocal curve.

(a) Write down the equations of the two lines of symmetry of the graph. **(2)**

.....

(b) State the equation of the vertical line and the equation of the horizontal line that the graph never crosses. **(2)**

(Total for Question 10 is 4 marks)

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11 A transformed reciprocal curve has equation $y = -3/(x + 1) + 4$.

(a) State the vertical and horizontal asymptotes. **(2)**

(b) Find the x-intercept (give as an exact value). **(2)**

(Total for Question 11 is 4 marks)

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12 The table shows values of $f(x) = x^3 - 3x + 1$ for integer values of x from -2 to 2.

x : -2 , -1 , 0 , 1 , 2

f(x) : -1 , 3 , 1 , -1 , 3

(a) Show that f(-1) = 3. **(1)**

(b) Using the table, write down the three intervals (each of width 1) in which the equation $x^3 - 3x + 1 = 0$ has a solution. **(3)**

(c) State the total number of real solutions to the equation $x^3 - 3x + 1 = 0$. **(1)**

(Total for Question 12 is 5 marks)

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13 The graphs of $y = x^3$ and $y = 4/x$ intersect at one point where $x > 0$.

(a) Show that the x-coordinate of this point satisfies $x^4 = 4$. **(2)**

(b) Hence find the exact value of x at this point. **(2)**

(Total for Question 13 is 4 marks)

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Mark scheme · 5.10 Drawing Other Graphs: Cubic/Reciprocal: Test Pack

Question 1

8 cao **B1**

Answer: 8

Question 2

(a) -8 cao **B1**

(a) Answer: -8

(b) 1 cao **B1**

(b) Answer: 1

Question 3

(a) A (Linear) **B1**

(a) Answer: A) Linear

(b) B (Quadratic) **B1**

(b) Answer: B) Quadratic

(c) C (Cubic) **B1**

(c) Answer: C) Cubic

(d) D (Reciprocal) **B1**

(d) Answer: D) Reciprocal

Question 4

(a) translated 2 units up oe **B1**

(a) Answer: Translated 2 units up.

(b) (0, 2) cao **B1**

(b) Answer: (0, 2)

Question 5

(a) (0, 2) cao **B1**

(a) Answer: (0, 2)

(b) Yes, because it has the same basic shape as $y=x^3$, which increases throughout, just shifted up oe **B1**

(b) Answer: Yes, y increases throughout

(c) translation by vector (0, 2), i.e. 2 units up, oe **B1**

(c) Answer: Translation 2 units up (vector (0,2))

Question 6

(a) sets each factor equal to 0 **M1**

(a) x = 1, x = -3, x = 2, all correct (any order) **A1**

(a) Answer: x = 1, x = -3, x = 2

(b) substitutes x = 0 into y = (x-1)(x+3)(x-2) **M1**

(b) (0, 6) cao **A1**

(b) Answer: (0, 6)

Question 7

(a) y = 3 **B1**

(a) Answer: y = 3

(b) x = 0 **B1**

(b) Answer: x = 0

(c) sets 2/x + 3 = 0 and rearranges to 2/x = -3 **M1**

(c) x = -2/3 exactly, so (-2/3, 0) **A1**

(c) Answer: (-2/3, 0)

Question 8

(a) translation 2 units right and 1 unit up oe **B1**

(a) Answer: Translate 2 units to the right and 1 unit up.

(b) apply translation to (2, 8): (2+2, 8+1) or equivalent method **M1**

(b) (4, 9) cao **A1**

(b) Answer: (4, 9)

Question 9

substitutes x=2 into x^3-3x-6, obtaining -4 **M1**

substitutes x=3 into x^3-3x-6, obtaining 12 **M1**

correct conclusion referencing the change of sign (from negative to positive), so a root lies between x=2 and x=3, cso **dM1**

Answer: f(2) = -4 and f(3) = 12; change of sign confirms a solution lies between x=2 and x=3 (shown)

Question 10

(a) y = x **B1**

(a) y = -x **B1**

(a) Answer: y = x and y = -x

(b) x = 0 **B1**

(b) y = 0 **B1**

(b) Answer: x = 0 and y = 0

Question 11

(a) vertical asymptote x = -1 stated **B1**

(a) horizontal asymptote y = 4 stated **B1**

(a) Answer: Vertical asymptote x = -1. Horizontal asymptote y = 4.

(b) set y = 0 and solve -3/(x+1) + 4 = 0 leading to -3/(x+1) = -4 **M1**

(b) x = -1/4 cao **A1**

(b) Answer: x = -1/4

Question 12

(a) $(-1)^3$-3(-1)+1=-1+3+1=3 cso **B1**

(a) Answer: 3 (shown)

(b) between x=-2 and x=-1 (sign changes from -1 to 3) **B1**

(b) between x=0 and x=1 (sign changes from 1 to -1) **B1**

(b) between x=1 and x=2 (sign changes from -1 to 3) **B1**

(b) Answer: Between x=-2 and x=-1; between x=0 and x=1; between x=1 and x=2

(c) 3, ft from part (b) **B1**

(c) Answer: 3 real solutions

Question 13

(a) sets $x^3 = 4/x$ and multiplies both sides by x **M1**

(a) correctly obtains $x^4 = 4$, cso **A1**

(a) Answer: $x^4 = 4$

(b) takes the square root of both sides to get $x^2 = 2$ (positive root, since $x^2 \geq 0$) **M1**

(b) $x = \sqrt{2}$ oe, cao (positive root only, since x > 0) **A1**

(b) Answer: $x = \sqrt{2}$

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