1 (a) Complete the table of values for $y = \frac{1}{2}x^3 - 2x + 3$

x	–3	–2	–1	0	1	2	3
y	–4.5	3	4.5	3	1.5	3	10.5

(2)

when $x = -2$, $y = \frac{1}{2}(-2)^3 - 2(-2) + 3$

$= \frac{1}{2}(-8) + 4 + 3 = 3$

when $x = -1$, $y = \frac{1}{2}(-1)^3 - 2(-1) + 3$

$= \frac{1}{2}(-1) + 2 + 3 = 4.5$

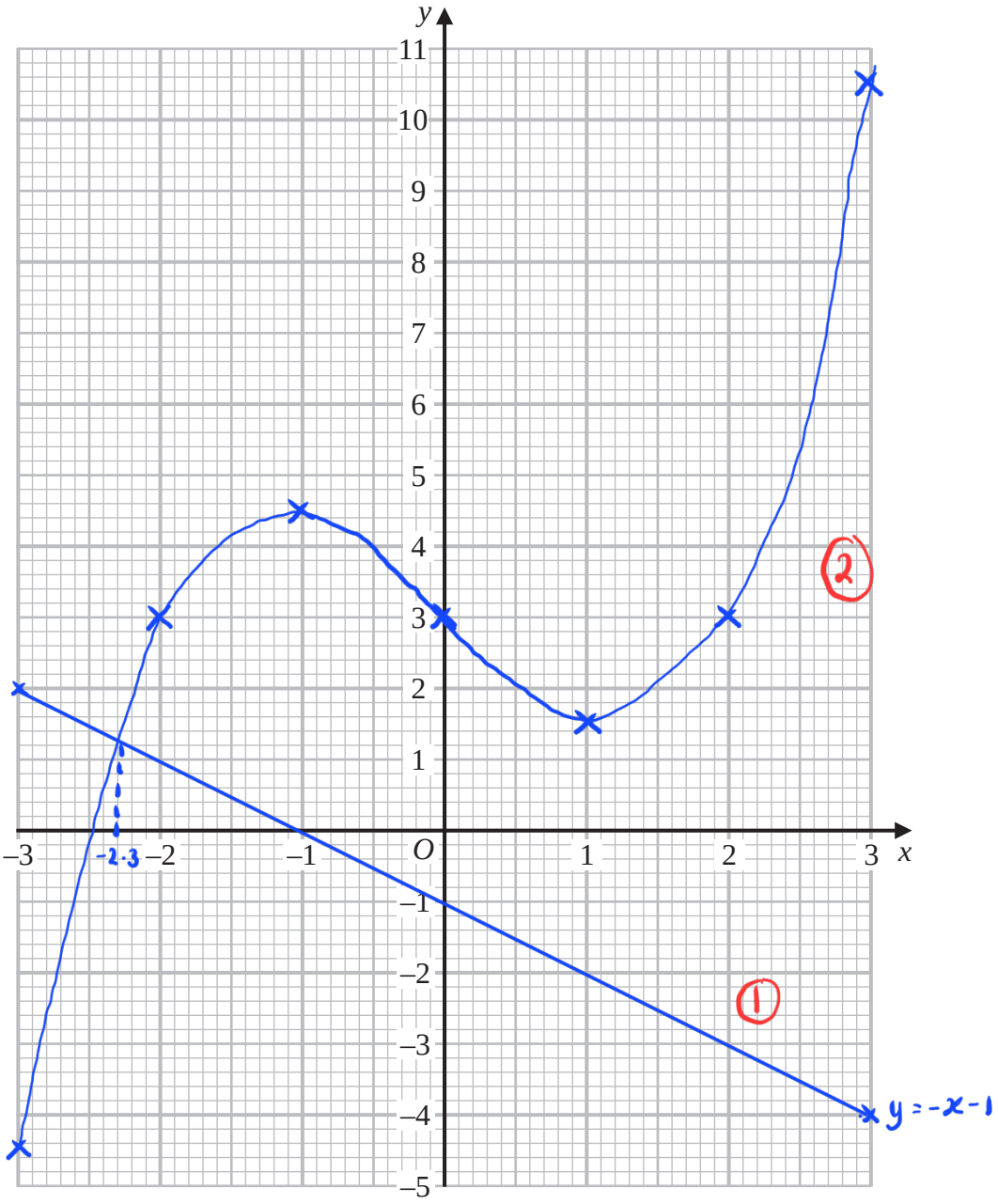
when $x = 1$, $y = \frac{1}{2}(1)^3 - 2(1) + 3$

$= \frac{1}{2}(1) - 2 + 3 = 1.5$

when $x = 3$, $y = \frac{1}{2}(3)^3 - 2(3) + 3$

$= \frac{1}{2}(27) - 6 + 3 = 10.5$

(b) On the grid, draw the graph of $y = \frac{1}{2}x^3 - 2x + 3$ for $-3 \leqslant x \leqslant 3$



(2)

(c) By drawing a suitable straight line on the grid, find an estimate for the solution of the equation $\frac{1}{2}x^3 - x + 4 = 0$

$\frac{1}{2}x^3 - x + 4 = 0$

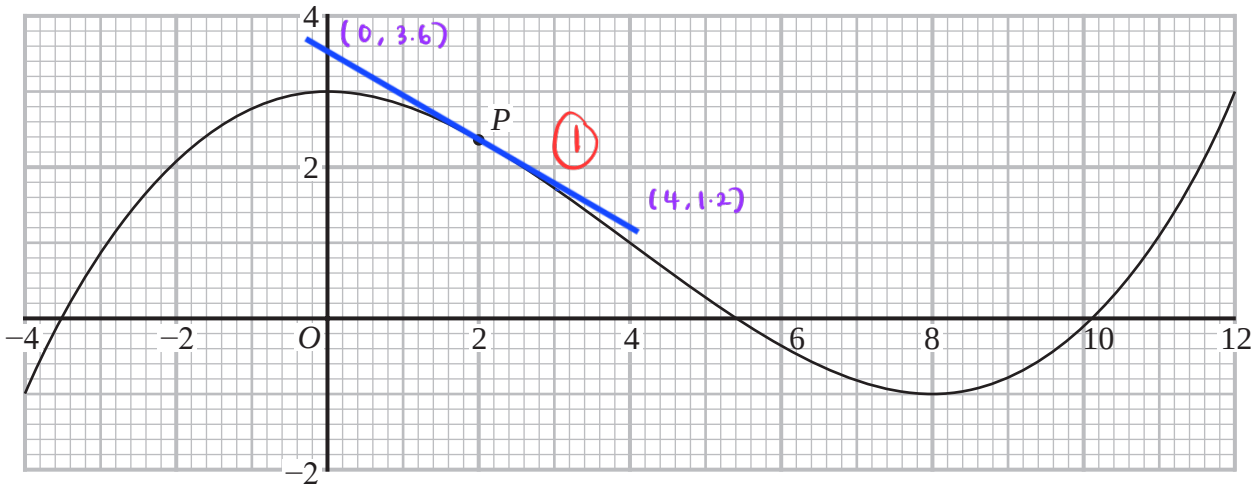
$\frac{1}{2}x^3 - 2x + 3 = -x - 1$ $+(-x-1)$

$x =$ -2.3 (1)

(2)

(Total for Question 1 is 6 marks)

2 The diagram shows the graph of $y = f(x)$ for $-4 \leqslant x \leqslant 12$



The point P on the curve has x coordinate 2

(a) (i) Use the graph to find an estimate for the gradient of the curve at P.

$m = \dfrac{3.6 - 1.2}{0 - 4}$ (1)

$= -0.6$

-0.6 (1)

(3)

(ii) Hence find an equation of the tangent to the curve at P.
Give your answer in the form $y = mx + c$

$y = mx + c$ ← y-intercept

$y = -0.6x + 3.6$ (1)

y-intercept $= 3.6$

(1)
$y = -0.6x + 3.6$

(2)

The equation $f(x) = k$ has exactly two different solutions for $-4 \leqslant x \leqslant 12$

(b) Use the graph to find the two possible values of k.

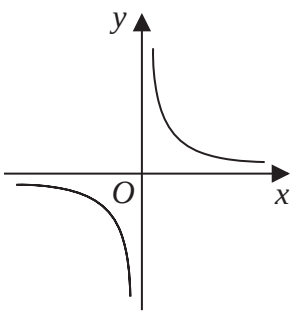
-1 (1), 3 (1)

(2)

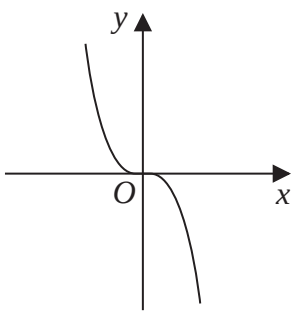
(Total for Question 2 is 7 marks)

3 Here are six graphs.

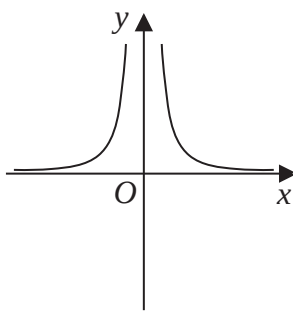
Graph A



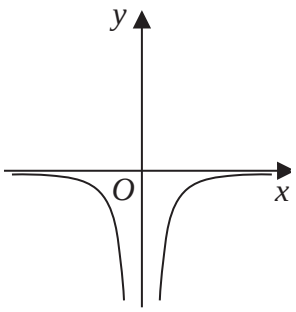
Graph B



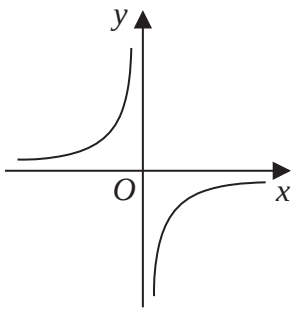
Graph C



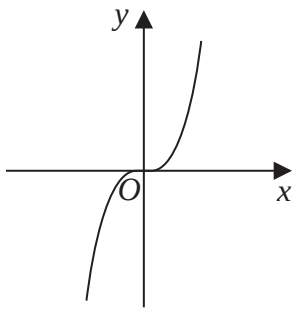
Graph D



Graph E



Graph F



Complete the table below with the letter of the graph that could represent each given equation.

Write your answers on the dotted lines.

Equation	Graph
$y = \frac{2}{x^2}$	C (1)
$y = -\frac{1}{2}x^3$	B (1)
$y = -\frac{5}{x}$	E (1)

– y will always be positive

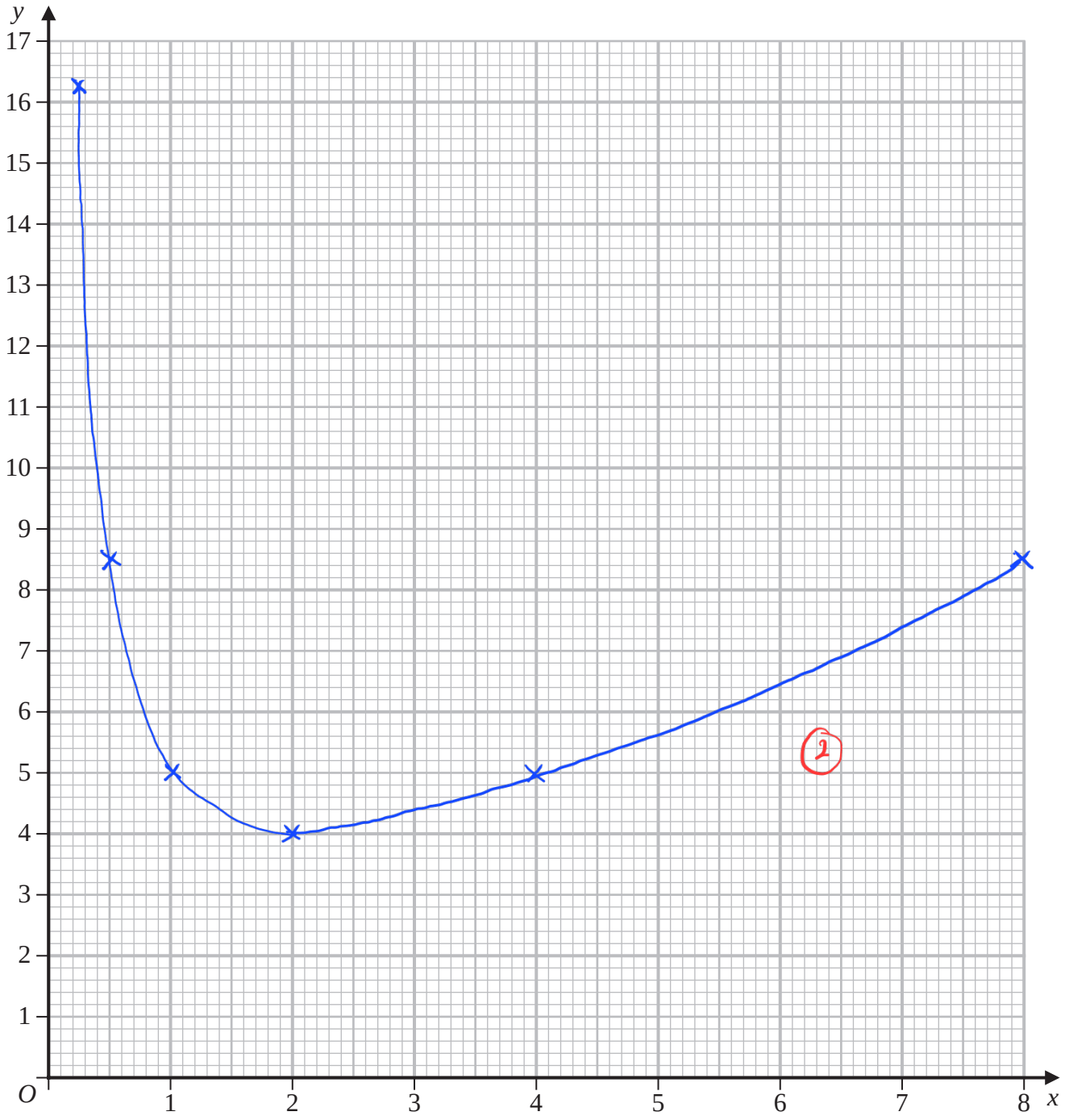
(Total for Question 3 is 3 marks)

4 (a) Complete the table of values for $y = \frac{1}{x}(x^2 + 4)$

x	0.25	0.5	1	2	4	8
y	16.25	8.5	5	4	5	8.5

1 (2)

(b) On the grid, draw the graph of $y = \frac{1}{x}(x^2 + 4)$ for $0.25 \leqslant x \leqslant 8$



(2)

(Total for Question 4 is 4 marks)

5 The point A is the only stationary point on the curve with equation $y = kx^2 + \frac{16}{x}$ where k is a constant.

Given that the coordinates of A are $\left(\frac{2}{3}, a\right)$

find the value of a.
Show your working clearly.

Stationary point : $\frac{dy}{dx} = 0$

(1)

$\frac{dy}{dx} = 2kx - \frac{16}{x^2}$ (1)

$2kx - \frac{16}{x^2} = 0$ (1)

$2kx^3 - 16 = 0$

$kx^3 = \frac{16}{2}$

$kx^3 = 8$

$x^3 = \frac{8}{k}$

$x = \sqrt[3]{\frac{8}{k}}$

Given $x = \frac{2}{3}$,

$\frac{2}{3} = \sqrt[3]{\frac{8}{k}}$

$k = 27$ (1)

Substitute $k = 27$ and $x = \frac{2}{3}$ into equation of curve:

$y = 27\left(\frac{2}{3}\right)^2 + \frac{16}{\frac{2}{3}}$

$= 36$

$a = 36$ (1)

$a =$ 36

(Total for Question 5 is 5 marks)

6 The diagram shows a sketch of part of the curve with equation $y = x^2 - \frac{p}{x}$ where p is a positive constant.

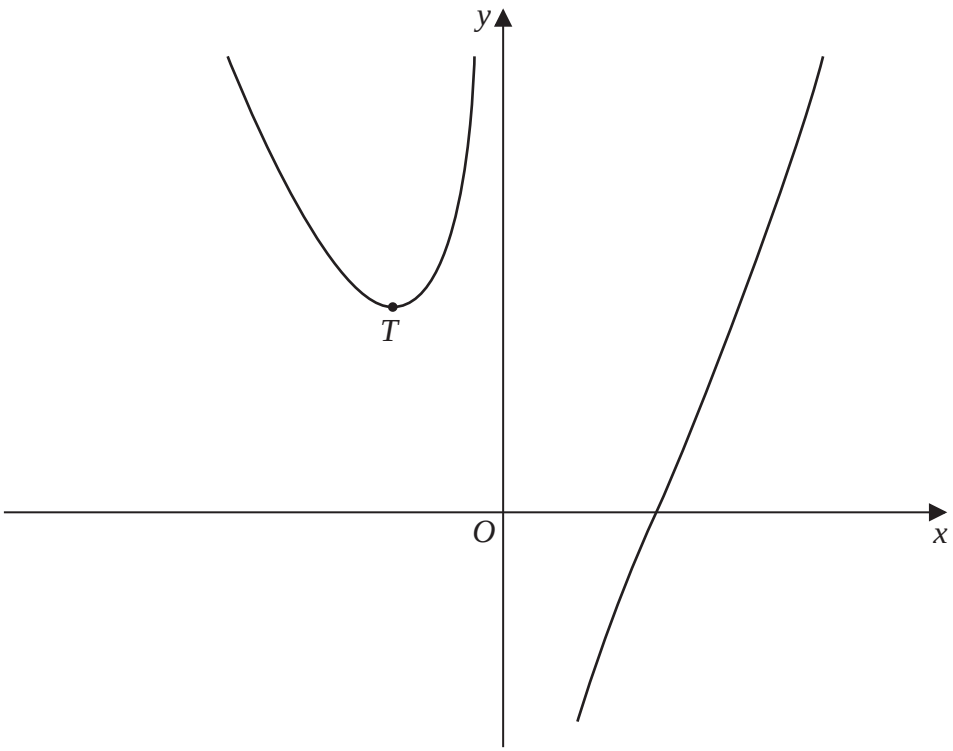


Diagram **NOT** accurately drawn

For all values of p, the curve has exactly one turning point and this turning point is a minimum shown as the point T in the sketch.

For the curve where the x coordinate of T is –3

(a) find the value of p

turning point: $\frac{dy}{dx} = 0$

$\frac{dy}{dx} = 2x + \frac{p}{x^2} = 0$ (1) (1)

When $x = -3$

$2(-3) + \frac{p}{(-3)^2} = 0$ (1)

$p = 54$ (1)

$p =$ 54

(4)

The line with equation $y = k$ is a tangent to the curve with equation $y = x^2 - \frac{16}{x}$

(b) Find the value of k

tangent $= \frac{dy}{dx} = 0$

$\frac{dy}{dx} = 2x + \frac{16}{x^2}$

$2x + \frac{16}{x^2} = 0$ (1)

$2x^3 + 16 = 0$

$x^3 = -\frac{16}{2}$

$x^3 = -8$

$x = \sqrt[3]{-8}$

$= -2$ (1)

$y = (-2)^2 - \frac{16}{-2}$

$= 4 + 8$

$= 12$ (1)

$k = y = 12$

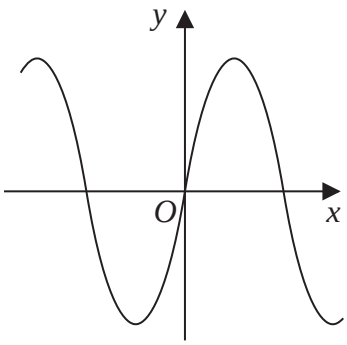
$k =$ 12 .....

(3)

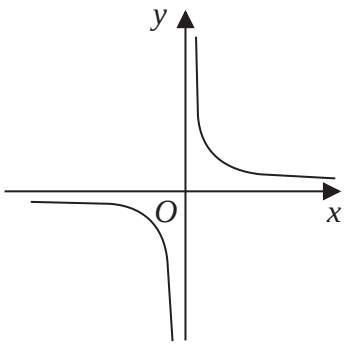
(Total for Question 6 is 7 marks)

7 Here are nine graphs.

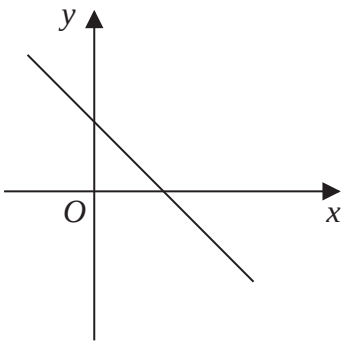
Graph A



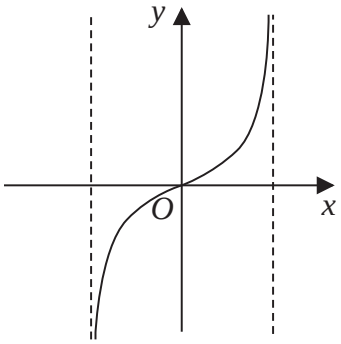
Graph B



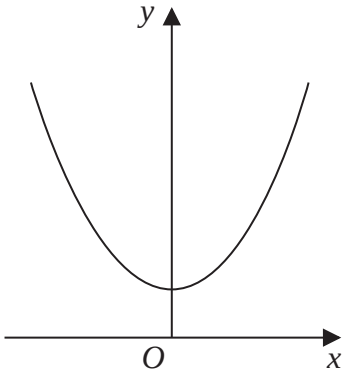
Graph C



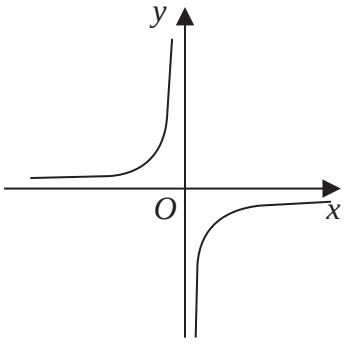
Graph D



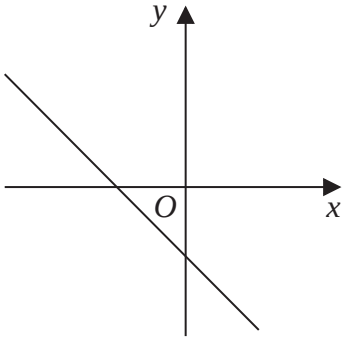
Graph E



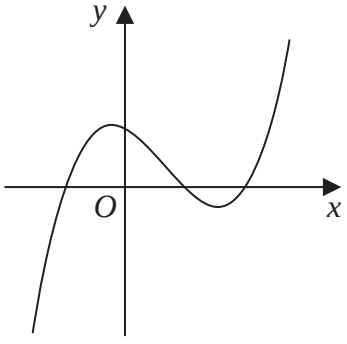
Graph F



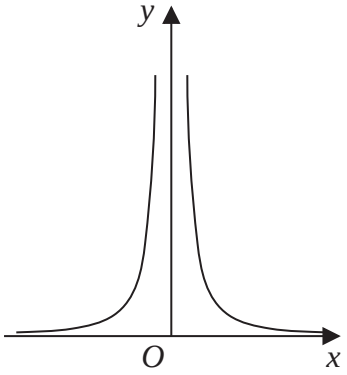
Graph G



Graph H



Graph I



Complete the table below with the letter of the graph that could represent each given equation.
Write each answer on the dotted line.

Equation	Graph
$y = -2x + 3$ y-intercept at 3	C
$y = -\frac{1}{x}$	F
$y = \tan x°$	D
$y = (x + 1)(x - 1)(x - 2)$	H

3

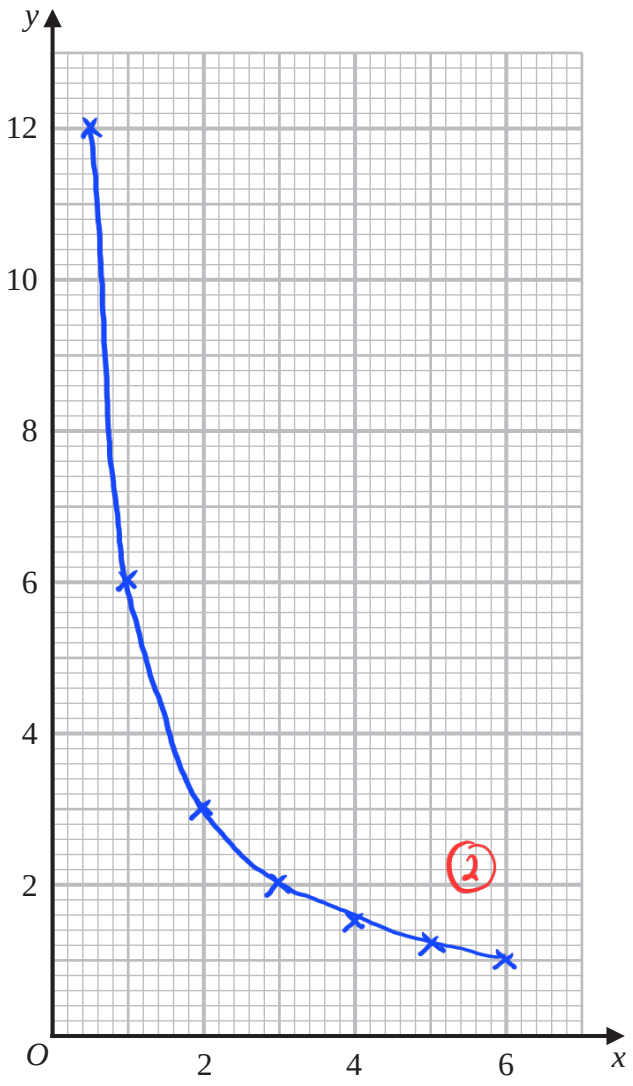
(Total for Question 7 is 3 marks)

8 (a) Complete the table of values for $y = \frac{6}{x}$

x	0.5	1	2	3	4	5	6
y	12	6	3	2	1.5	1.2	1

(2)

(b) On the grid, draw the graph of $y = \frac{6}{x}$ for $0.5 \leqslant x \leqslant 6$



(2)

(Total for Question 8 is 4 marks)

9 The curve **C** has equation $y = ax^3 + bx^2 - 12x + 6$ where a and b are constants.

The point A with coordinates $(2, -6)$ lies on **C**
The gradient of the curve at A is 16

Find the y coordinate of the point on the curve whose x coordinate is 3
Show clear algebraic working.

$-6 = a(2)^3 + b(2)^2 - 12(2) + 6$

$-6 = 8a + 4b - 24 + 6$

$8a + 4b = 12$ – ①

①

gradient, $\frac{dy}{dx} = 3ax^2 + 2bx - 12$ ①

$16 = 3a(2)^2 + 2b(2) - 12$

$16 = 12a + 4b - 12$

$4b = 28 - 12a$ – ② ①

② into ① :

$8a + 2(8 - 12a) = 12$

$-4a = -16$

$a = 4$

$b = -5$ ①

$y = 4(3)^3 - 5(3)^2 - 12(3) + 6$ ①

$= 108 - 45 - 36 + 6$

$= 33$ ①

$y =$ 33

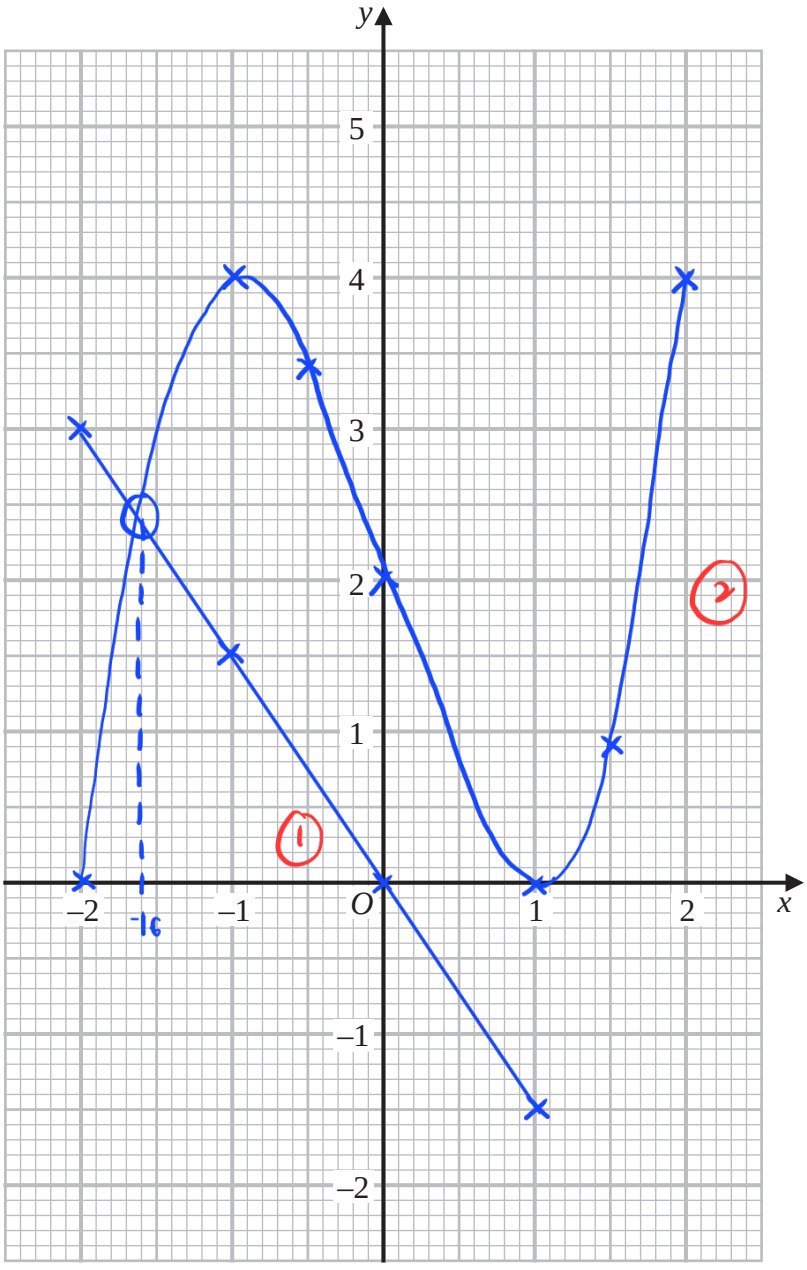
(Total for Question 9 is 6 marks)

10 (a) Complete the table of values for $y = x^3 - 3x + 2$

x	–2	–1	–0.5	0	1	1.5	2
y	0	4	3.4	2	0	0.9	4

(2)

(b) On the grid, draw the graph of $y = x^3 - 3x + 2$ for values of x from –2 to 2



(2)

(c) By drawing a suitable straight line on the grid, use your graph to find an estimate for the solution of

$$2x^3 - 3x + 4 = 0$$

Give your answer correct to one decimal place.

$2 \times y = (x^3 - 3x + 2) \times 2$

$2y = 2x^3 - 6x + 4$

$-$

$2x^3 - 3x + 4 = 0$

$2y = -3x$

$y = -\frac{3}{2}x$ (1)

-1.6 (1)

.....

(3)

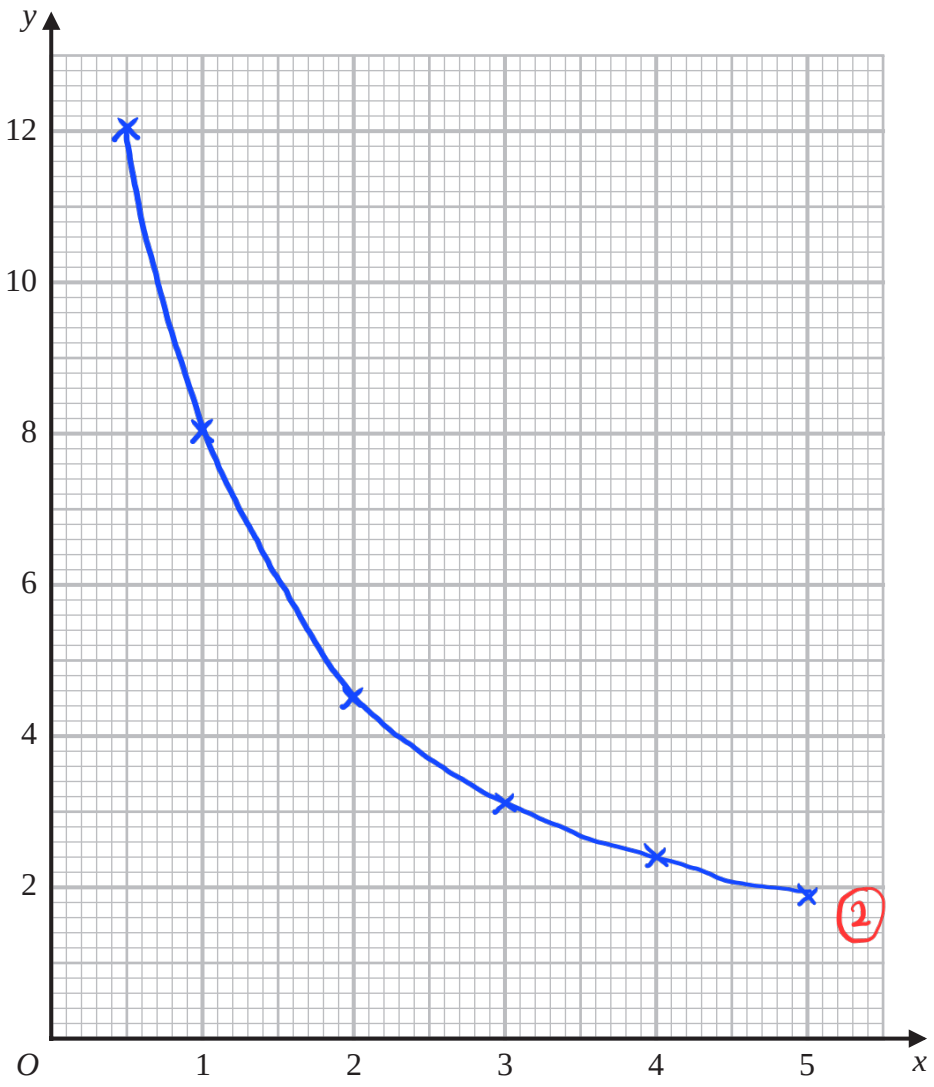
(Total for Question 10 is 7 marks)

11 (a) Complete the table of values for $y = \frac{2}{x}\left(5 - \frac{1}{x}\right)$

x	0.5	1	2	3	4	5
y	12	8	4.5	3.1	2.4	1.9

(1)

(b) On the grid, draw the graph of $y = \frac{2}{x}\left(5 - \frac{1}{x}\right)$ for $0.5 \leqslant x \leqslant 5$

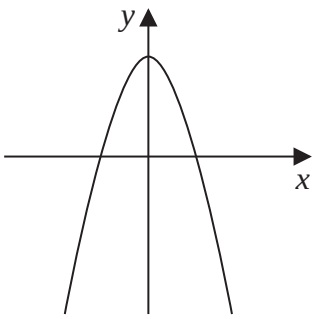


(2)

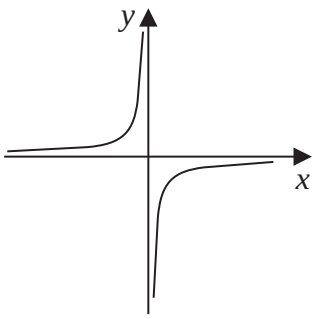
(Total for Question 11 is 3 marks)

12 Here are six graphs.

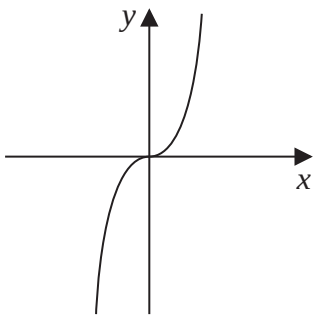
Graph A



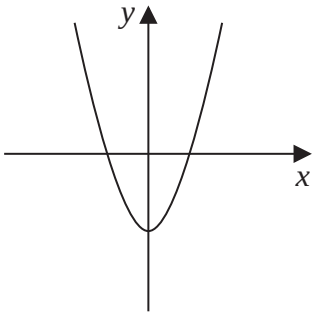
Graph B



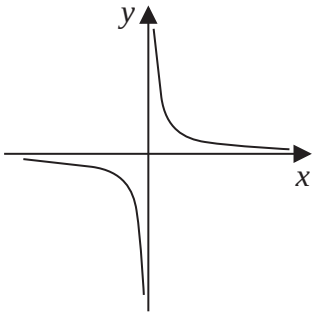
Graph C



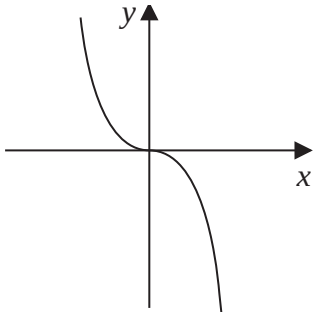
Graph D



Graph E



Graph F



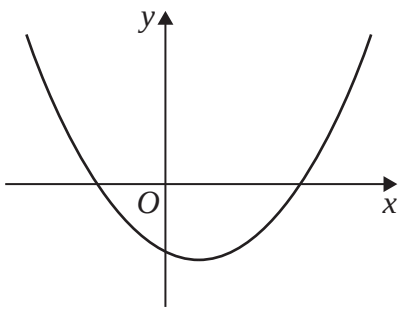
Complete the table below with the letter of the graph that could represent each given equation.
Write your answers on the dotted lines.

Equation	Graph
$y = -\frac{2}{x}$	B .....
$y = 5 - x^2$	A 3
$y = -2x^3$	F .....

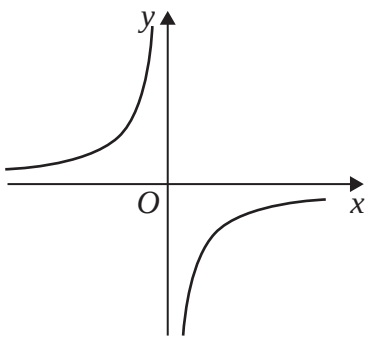
(Total for Question 12 is 3 marks)

13 Here are six graphs.

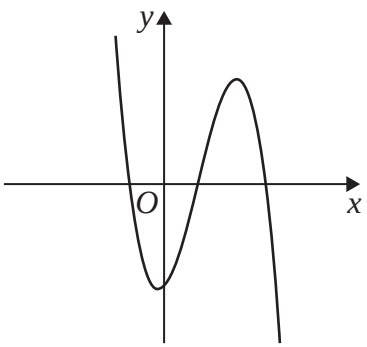
Graph **A**



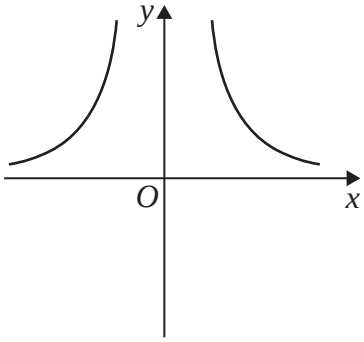
Graph **B**



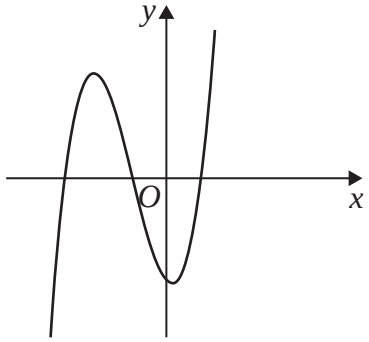
Graph **C**



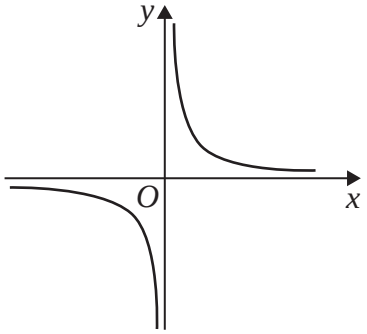
Graph **D**



Graph **E**



Graph **F**



Write down the letter of the graph of

(a) $y = \frac{10}{x^2}$ (reciprocal with positive values of y)

D (1)

.....

(1)

(b) $y = x - 3 + 3x^2 - x^3$

C (1)

.....

(1)

(c) $y = -\frac{3}{x}$

B (1)

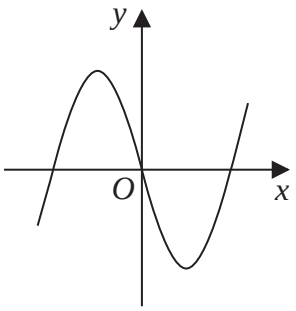
.....

(1)

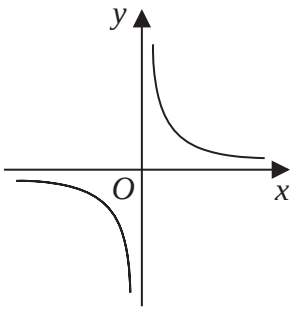
(Total for Question 13 is 3 marks)

14 Here are 6 graphs.

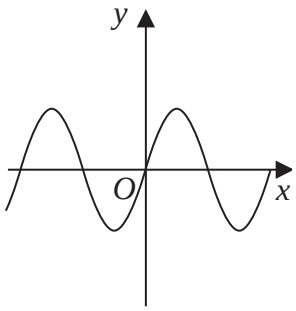
Graph A



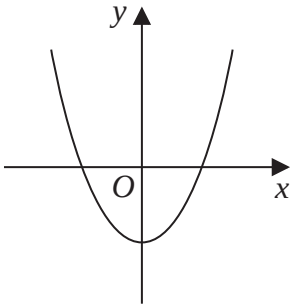
Graph B



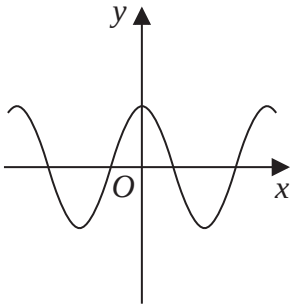
Graph C



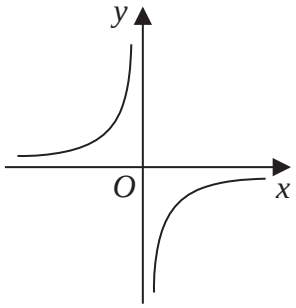
Graph D



Graph E



Graph F



Complete the table below with the letter of the graph that could represent each given equation.

Write your answers on the dotted lines.

Equation	Graph
$y = \sin x$	C (1)
$y = -\frac{3}{x}$	F (1)
$y = 4x^3 - 5x$	A (1)

(Total for Question 14 is 3 marks)