

Question 1 (18 Marks) – Start a new page**Marks**

a) Express 0.0000067583 in scientific notation correct to 3 sig. fig. 2

b) If $x = 2\frac{1}{4}$ and $y = -5$: Evaluate $\frac{7y - \sqrt{x}}{xy}$ 1

c) Expand and simplify:

i) $(2y^3 + 3)^2$ 1

ii) $x^2 - 2x^3 + 7 - x(x - 2x^2)$ 2

iii) $(a - 2b)^3$ 2

d) Factorise fully:

i) $2a^2 + ab - 6b^2$ 1

ii) $n^5 + 243$ 2

iii) $x^2 - z^2 - y^2 + 2yz$ 2

e) Fully simplify each of these algebraic fractions:

i) $\frac{6ab^3}{(2a^2b)^3}$ 1

ii) $\frac{n-5}{n+1} - \frac{25}{n^2-4n-5}$ 2

iii) $\frac{x-1}{x^2-4} \div \frac{x^3-1}{x+2}$ 2

Question 2 (13 Marks) – Start a new page**Marks**

a) Label each of the following as a ‘function’ or ‘not a function’:

3

i) $x = \sqrt{25 - y^2}$ ii) $\{(2,1), (5,2), (7,1)\}$ iii) $x = y^2$

iv) $x = \frac{2}{y+1}$ v) $y = x^3 + 2$

b) For the functions: $f(x) = x^2 + 1$; and $g(x) = x - 2$. Evaluate

i) $f(5)$ ii) $f(x^2 + 1)$ iii) $g(f(-1))$

4

c) State the domain and range of:

i) $y = \sqrt{x + 2}$ ii) $y = \sqrt{64 - x^2}$

4d) Is $f(x) = \frac{2x}{x^4+3}$: odd; even; or neither. Justify your answer with working.**2****Question 3** (8 Marks) – Start a new pagea) Solve for x :

i) $5 - 2(3 - x) = 8 - x$

2

ii) $\frac{x+2}{x+5} = \frac{1-2x}{10-2x}$

3b) Make x the subject of the equation: $7 - y(2 - x) = 5 + x(3 + w + z)$ **3****Examination continues over page**

Question 4 (19 Marks) – Start a new page**Marks**

a) If $f(x) = 2^x$, sketch each of the following on separate sets of axes.

i) $y = f(x)$ **1**

ii) $y = f(x) + 2$ **1**

iii) $y = f(x - 1)$ **1**

iv) $y = -f(-x)$ **2**

b) Sketch each of the following, showing all relevant features:

i) $y = \frac{x^2-1}{x-1}$ **2**

ii) $y = (x - 2)(x - 1)^2$ **3**

iii) $x^2 + y^2 - 4x - 6y + 12 = 0$ **3**

c) For the function $f(x) = \frac{x+1}{x+2}$

i) Show that $f(x) = 1 - \frac{1}{x+2}$ **1**

ii) Hence or otherwise sketch $y = f(x)$ **3**

d) Sketch $f(x) = x + |2x + 4|$ showing all important features **3**

End of Examination

Q1

a) 6.76×10^{-6}

✓ rounding
✓ index

b) $3\frac{11}{45}$

✓

c) i) $4y^6 + 12y^3 + 9$

✓

ii) $x^2 - 2x^3 + 7 - x^2 + 2x^3$
 $= 7$

✓
✓

iii) $a^3 - 6a^2b + 12ab^2 - 8b^3$

✓✓ -1 if 1 error

d) i) $(a + 2b)(a - 3b)$

✓

ii) $(n + 3)(n^4 - 3n^3 + 9n^2 - 27n + 81)$

✓✓ 1 for each factor

iii) $x^2 - (y - z)^2$
 $= (x - y + z)(x + y - z)$

✓
✓

e) i) $\frac{3}{4}a^5$

✓

ii) $\frac{(n-5)^2}{(n+1)(n-5)} - \frac{25}{(n+1)(n-5)}$
 $= \frac{n^2 - 10n + 25 - 25}{(n+1)(n-5)}$
 $= \frac{n(n-10)}{(n+1)(n-5)}$

✓

✓

iii) $\frac{\cancel{x}-1}{(x-2)(\cancel{x}+2)} \times \frac{(x+2)}{(\cancel{x}-1)(x^2+x+1)}$

✓

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

✓

Q2

- a) i) not a function
 ii) function
 iii) not a function
 iv) function
 v) function

} 3 marks total
 -1 for each error

b) i) $5^2 + 1 = 26$ ✓

ii) $(x^2 + 1)^2 + 1 = x^4 + 2x^2 + 1 + 1$
 $= x^4 + 2x^2 + 2$ ✓

iii) $g((-1)^2 + 1) = g(2)$ ✓
 $= 2 - 2$
 $= 0$ ✓

c) i) D: $x \geq -2$ ✓
 R: $y \geq 0$ ✓

ii) D: $-8 \leq x \leq 8$ ✓
 R: $0 \leq y \leq 8$ ✓

d) $f(-x) = \frac{2(-x)}{(-x)^4 + 3}$ ✓

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

$$= -f(x)$$

∴ $f(x)$ is odd ✓

Q3

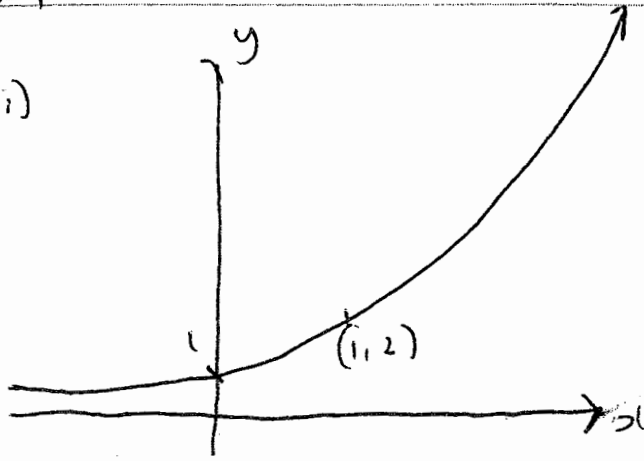
$$\begin{aligned} \text{a) i)} \quad 5 - 6 + 2x &= 8 - x \quad \checkmark \\ 2x + x &= 8 - 5 + 6 \\ 3x &= 9 \\ x &= 3 \quad \checkmark \end{aligned}$$

$$\begin{aligned} \text{ii)} \quad (x+2)(10-2x) &= (1-2x)(x+5) \quad \checkmark \\ 10x - 2x^2 + 20 - 4x &= x + 5 - 2x^2 - 10x \quad \checkmark \\ 10x - 4x + 10x - x &= 5 - 20 \quad \checkmark \\ -15x &= -15 \\ x &= -1 \quad \checkmark \end{aligned}$$

$$\begin{aligned} \text{b)} \quad 7 - 2y + xy &= 5 + 3x + xw + xz \quad \checkmark \\ xy + 3x + xw + xz &= 5 - 7 + 2y \\ x(3 + w + y + z) &= 2y - 2 \quad \checkmark \\ \therefore x &= \frac{2(y-1)}{3+w+y+z} \quad \checkmark \end{aligned}$$

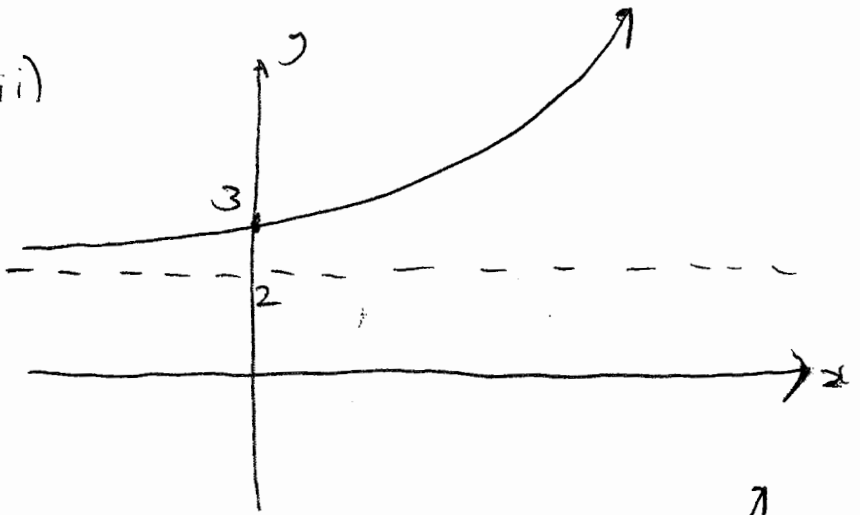
Q4

a) i)



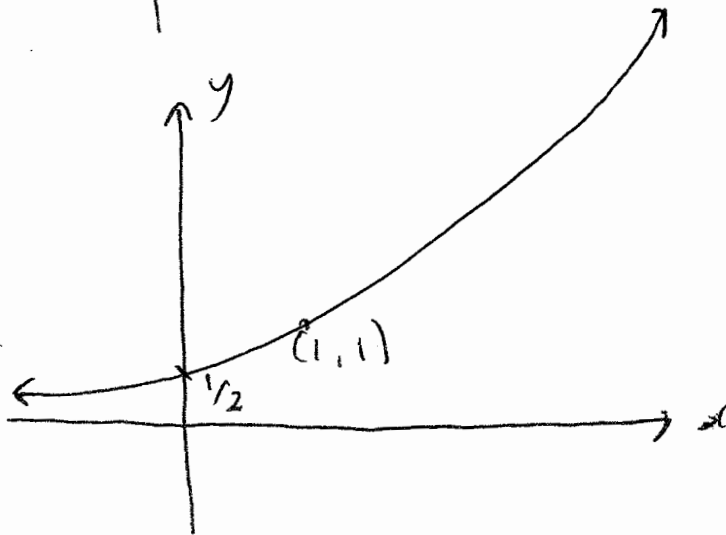
✓ must show
2 points

ii)



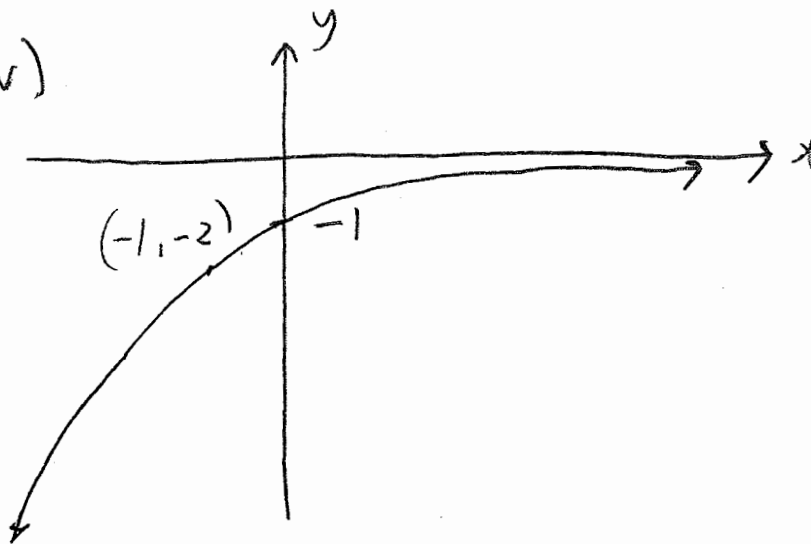
✓ must show
asymptote.

iii)



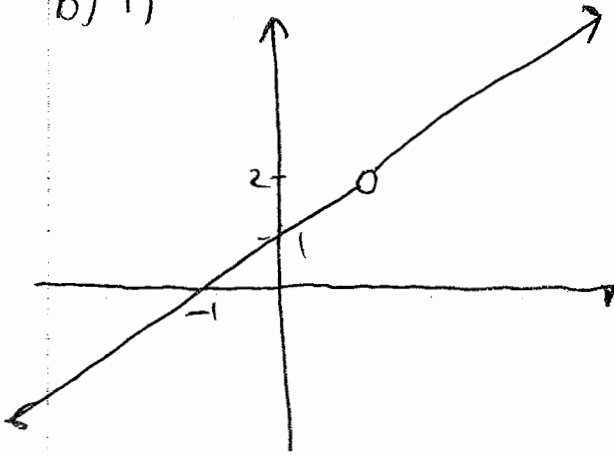
✓ only 1
point for
mark

iv)



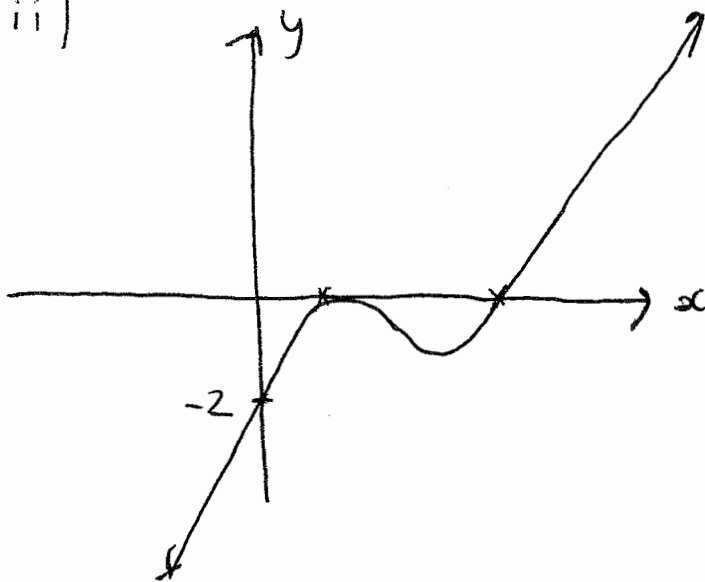
✓ 1 mark
for each
reflect.
(must show
at least 1
point)

b) i)



✓ line
✓ hole

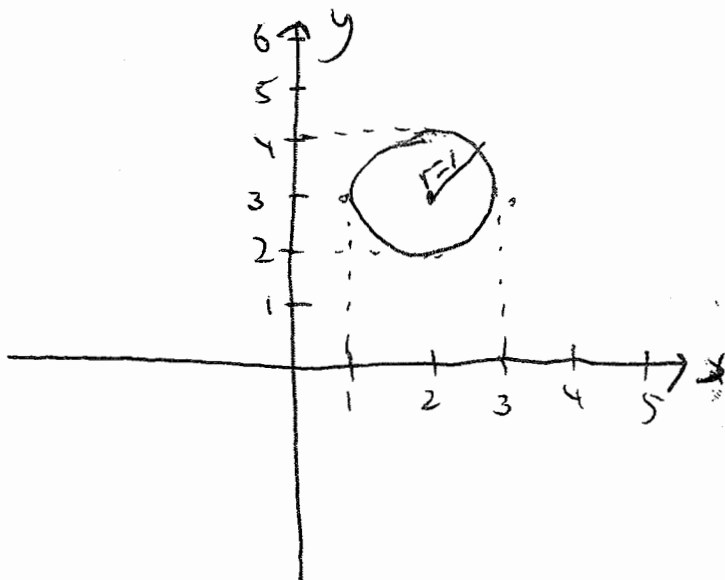
ii)



✓✓ shape & each intercept
✓ signs.

$$\text{iii) } x^2 - 4x + 4 + y^2 - 6y + 9 = 1$$

$$\therefore (x-2)^2 + (y-3)^2 = 1^2$$

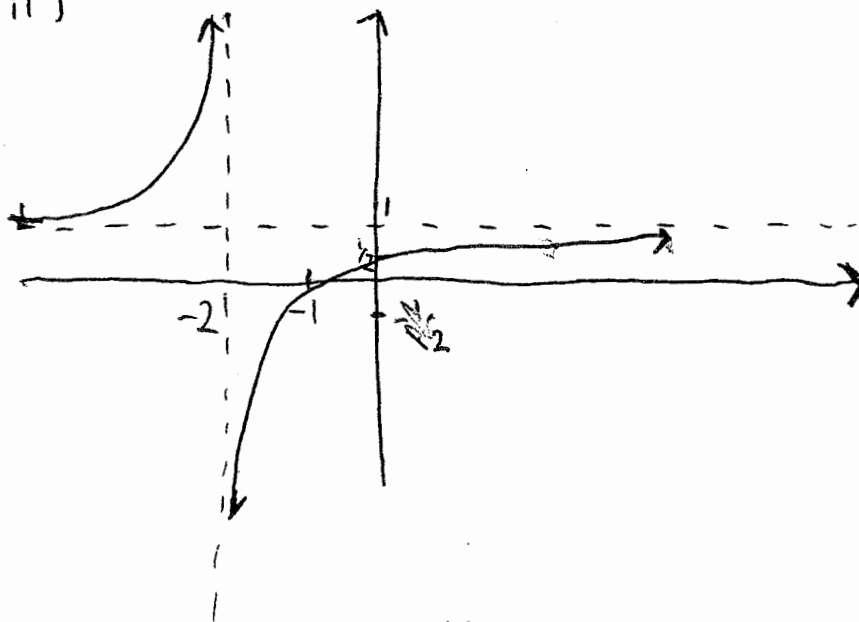


✓ completing square
✓ centre + radius
✓ correct graph.

c) i) $f(x) = \frac{x+2-1}{x+2}$
 $= 1 - \frac{1}{x+2}$

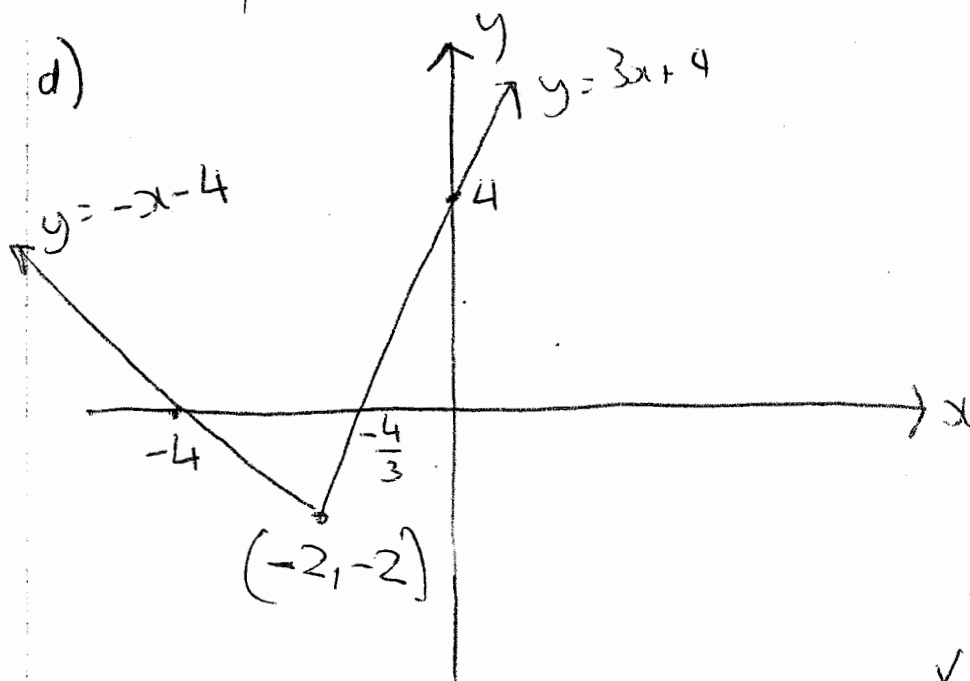
✓

ii)



✓ asymptotes
 ✓ intercepts
 ✓ shape.

d)



✓ vertex
 ✓✓ 1 each line.