Class slides

Graph of functions:

✓ 1 ↳ linear graphs
✓ 2 → Quadratic graph
3 → Cubic graphs
4 → reciprocal graphs

$y = x + 6$

linear

$y = +x^2 + 2x + 3$

2. Quadratic

$y = x^3 + x^2 + x \boxed{+6}$ → y-intercept
$y = x^3 + x^2 + x$

Cubic

$y = \frac{1}{x}$

reciprocal

Ex $\frac{1}{2}$.
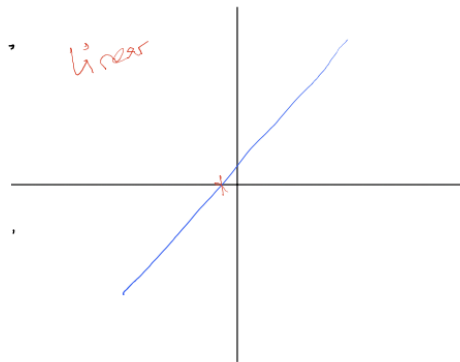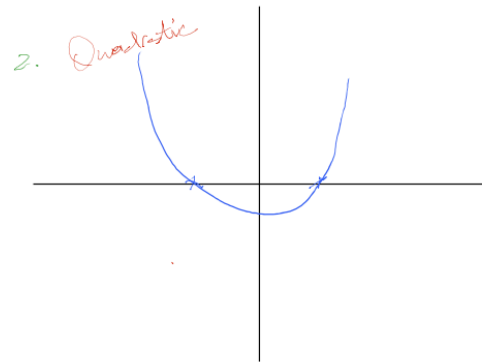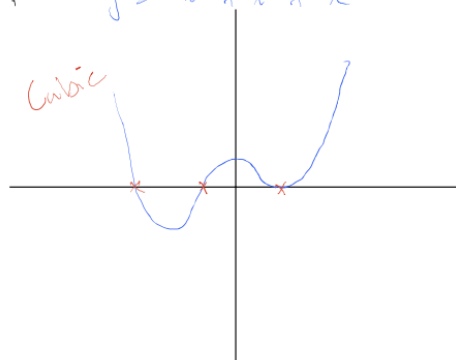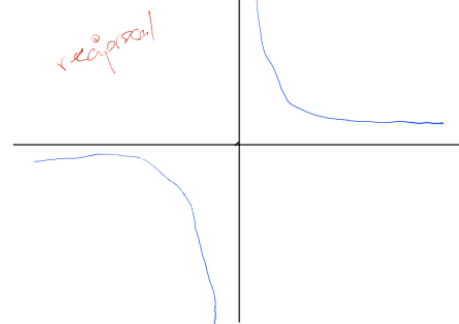
Sketch the graph of $y = x^2 - 1$, labelling any points where the graph intersects the coordinate axes.

Y_1 $\quad X_2$
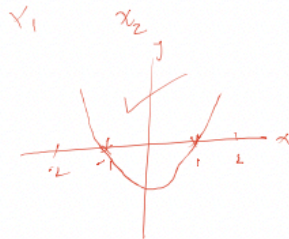
$y = x^2 - 1$

$0 = x^2 - 1$

$\sqrt{x^2} = \sqrt{1}$

$x = \pm 1$

$x_1 = +1 \quad x_2 = -1$

Q1

Sketch the graph of $y = x^2 + 3x - 4$, labelling any points where the graph intersects the coordinate axes.

Q3.

On the axes below sketch the graphs of both $y = 3x - 2$ and $y = x + 4$. ① ②

$\boxed{y = 3x - 2}$

$(0, y) \quad (x, 0)$

$y = 0x - 2$
$y = -2$

→ $(0, -2)$

$0 = 3x - 2$
$3x = 2$
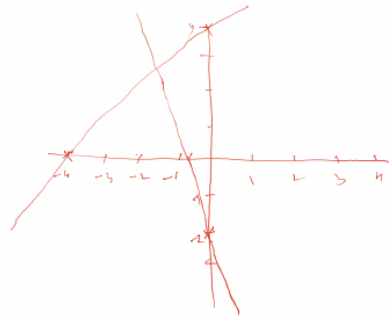$x = \frac{2}{3}$

→ $\left(\frac{2}{3}, 0\right)$

$y = x + 4$

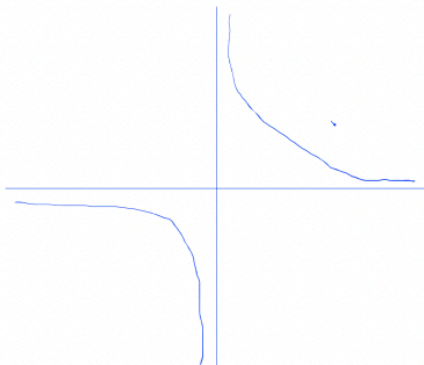$(0, y) \quad (x, 0)$

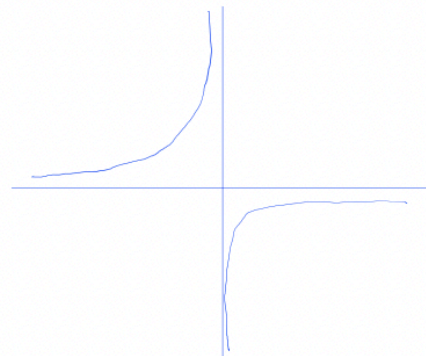$y = 0 + 4$
$(0, 4)$

$0 = x + 4$
$x = -4$

$(-4, 0)$

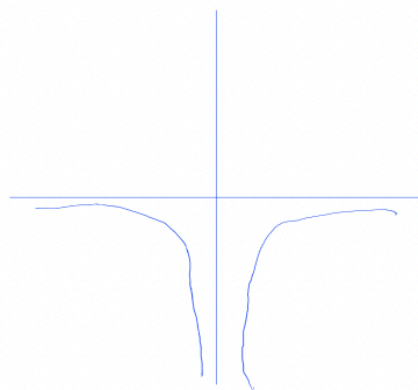## Reciprocal graphs :

$y = \frac{a}{x} \qquad a > 0$

$y = -\frac{a}{x} \qquad a < 0$

$y = \dfrac{q}{x}$
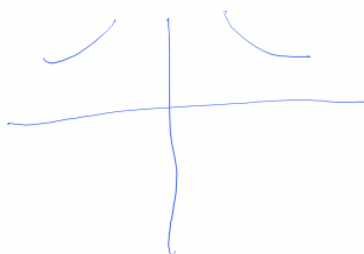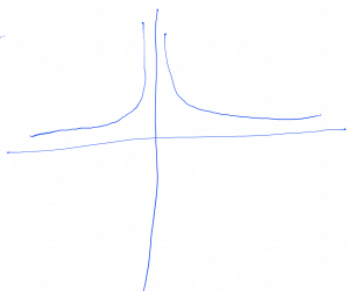
if q is close to zero

if is q is away from zero.

$y = \dfrac{q}{x^2}$

Q.
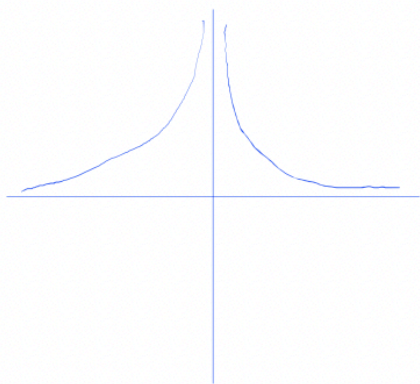
Sketch the graph of $y = 2x^3 - 3x^2 - 11x + 6$. $\;\;ax^3 + bx^2 + cx + d$ → Cubic

Label any points where the graph crosses the coordinate axes.

y-intercept
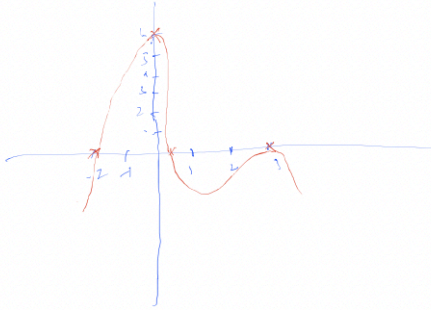
Y-int

$x = 0, y = +6$

X-int $y = 0$

$(x+2)(x-3)(2x-1)$

$x = -2, x = 3, x = \frac{1}{2}$

→ press mode button
→ Select 'EQN'
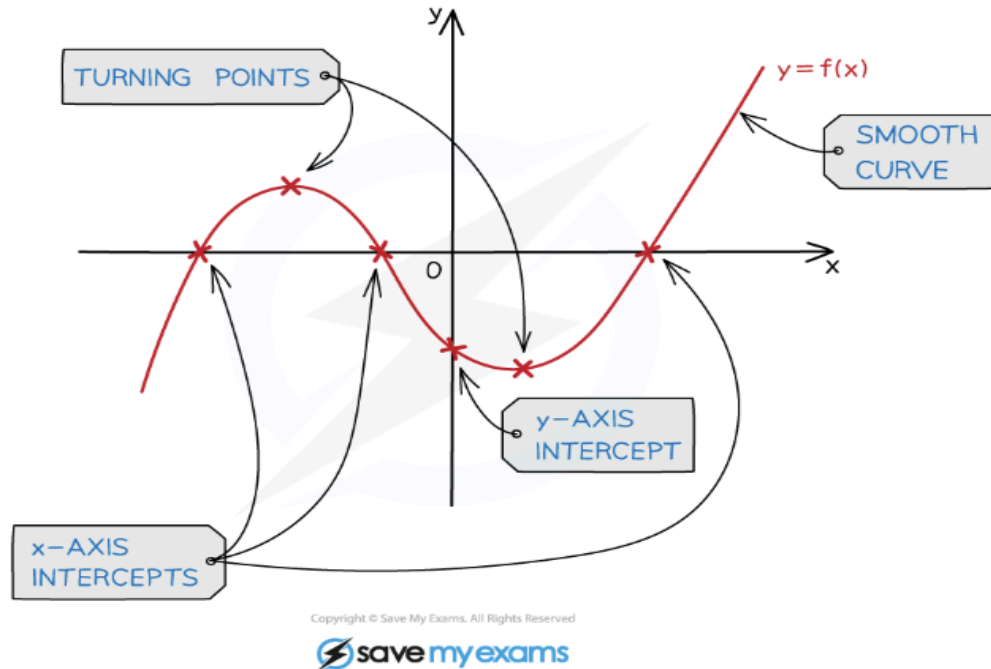→ Select Cubic eq.
→ input a, b, c and d values in eq
→ press '=' sign to get roots

Notes

Sketching Polynomials

Sketching the graph of a polynomial
- Remember a polynomial is any finite function with non-negative indices, that could mean a quadratic, cubic, quartic or higher power

- When asked to sketch a polynomial you'll need to think about the following
  - **y**-axis intercept
  - **x**-axis intercepts (**roots**)
  - turning points (**maximum** and/or **minimum**)
  - a smooth **curve** (this takes practice!)

How do I sketch a graph of a polynomial?

STEP 1   Find the **y**-axis intercept by setting **x = 0**

STEP 2   Find the **x**-axis intercepts (roots) by setting **y = 0**

STEP 3   Consider the shape and "start"/"end" of the graph

    eg. a **positive cubic** graph starts in third quadrant ("bottom left") and "ends" in first quadrant ("top right")

STEP 4   Consider where any turning points should go

STEP 5   Draw with a smooth curve

$y = x^3 - 4x$

AT x=0, y=0 (0,0)

STEP 2: SET y=0 TO FIND x–AXIS INTERCEPTS (ROOTS)

AT y=0, $x^3 - 4x = 0$

$x(x^2 - 4) = 0$ ← DIFFERENCE OF TWO SQUARES
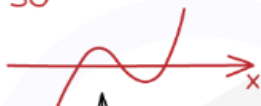
$x(x+2)(x-2) = 0$

$x=0, x=-2, x=2$

(0,0) (−2,0) (2,0) ← ALSO THE y–AXIS INTERCEPT

STEP 3: CONSIDER SHAPE AND "START/END" OF GRAPH
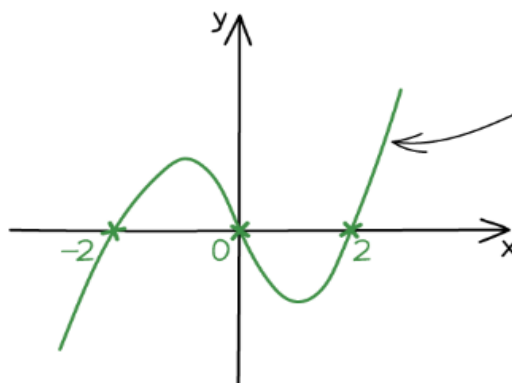
$y = x^3 - 4x$ POSITIVE CUBIC SO

OR

ONLY THIS ONE WILL CROSS x–AXIS THREE TIMES

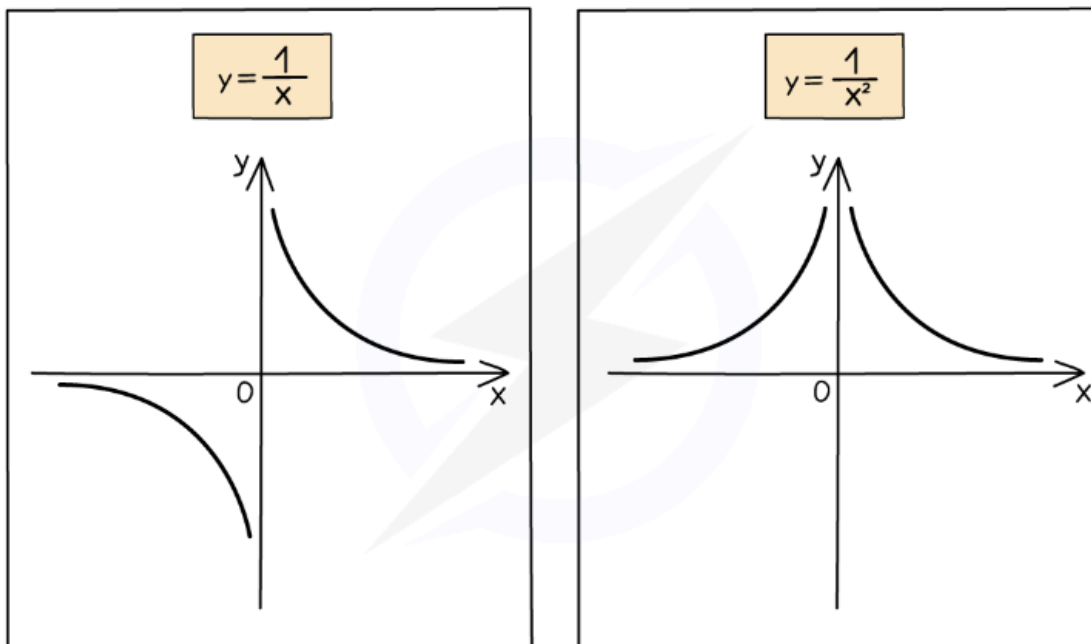STEP 4: TURNING POINTS

• ONE MINIMUM
• ONE MAXIMUM

SMOOTH CURVE

Reciprocal Graphs – Sketching

What are reciprocal graphs?

- Reciprocal graphs involve equations with an x term on the denominator e.g. $\dfrac{1}{x}$

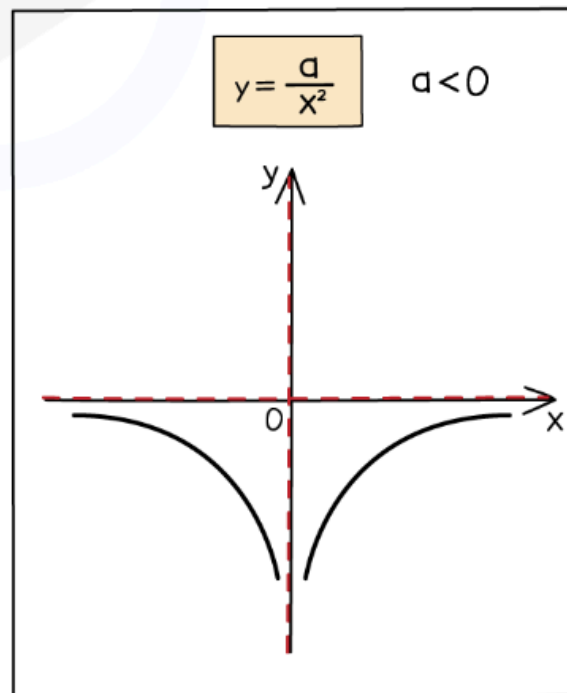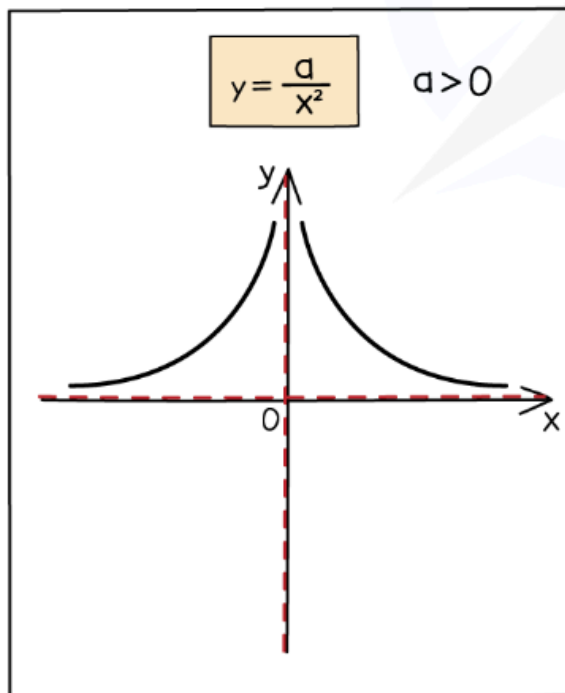- There are two basic reciprocal graphs to know for A level
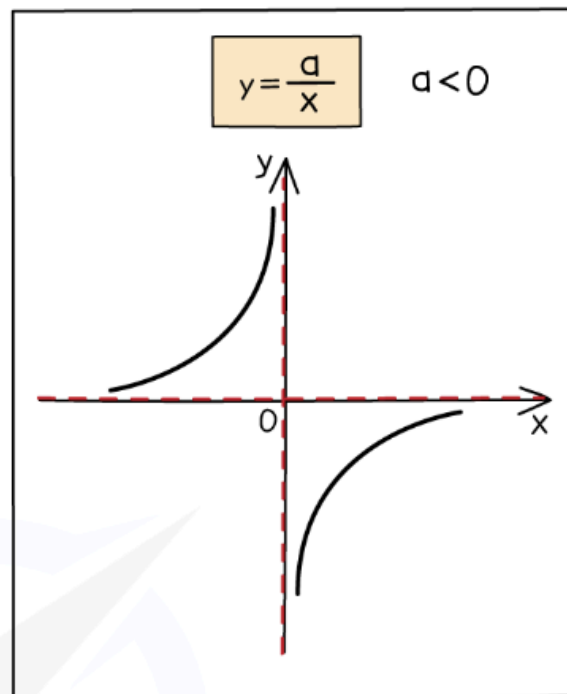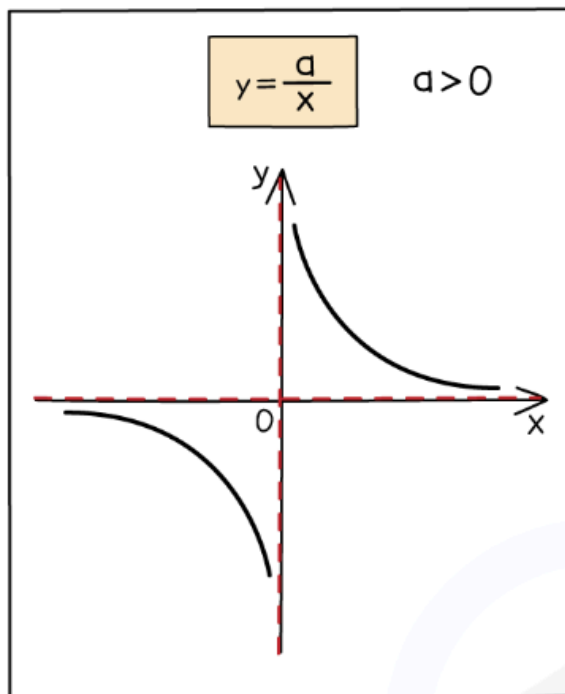
$$y = \frac{1}{x} \text{ and } y = \frac{1}{x^2}$$
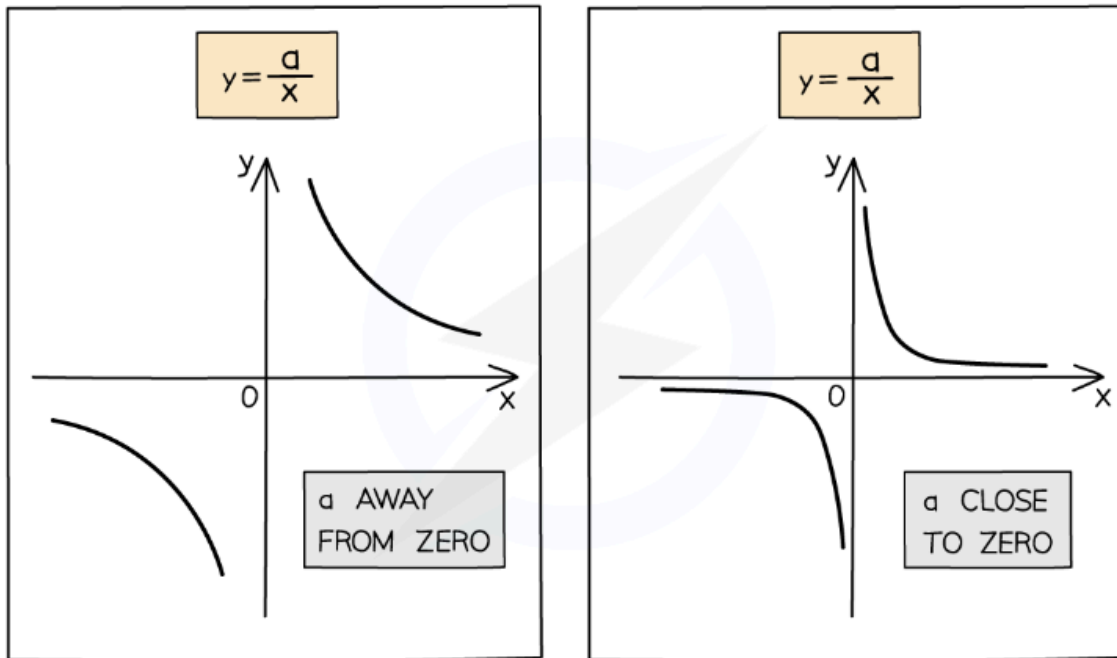
- The second one of these is always positive

More reciprocal graphs

- You also need to recognise graphs where the numerator is not one

$y = \dfrac{a}{x}$ $a > 0$

$y = \dfrac{a}{x}$ $a < 0$

$y = \dfrac{a}{x^2}$ $a > 0$

$y = \dfrac{a}{x^2}$ $a < 0$

- The **sign** of **a** shows which part of the graph the curves are located
- The **size** of **a** shows how steep the curves are
  - The closer **a** is to 0 the more **L–shaped** the curves are

$$y = \frac{a}{x}$$

a AWAY FROM ZERO

$$y = \frac{a}{x}$$

a CLOSE TO ZERO

- - horizontal, **y = 0 (x**-axis)
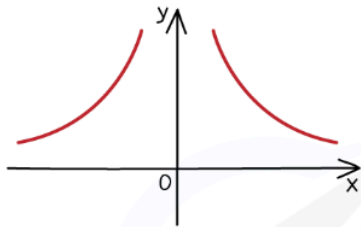   - vertical, **x = 0 (y**-axis)All have two **asymptotes**

How do I sketch a reciprocal graph?
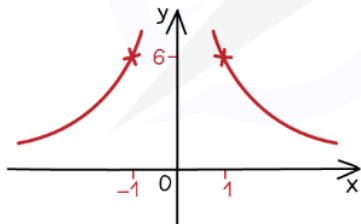
e.g. $y = \dfrac{6}{x^2}$

STEP 1: USE **SIGN** OF "a" TO LOCATE CURVES
USE **SIZE** OF "a" TO GAUGE STEEPNESS

a>0, CURVES IN POSITIVE AREAS
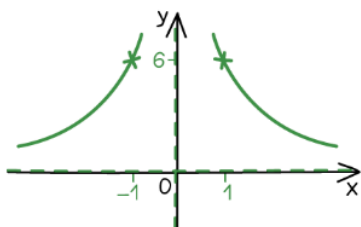a=6, LARGE COMPARED TO 1, LESS L-SHAPED

STEP 2: SKETCH THE GRAPH

STEP 3: LABEL x=1 & x=−1 AS A GUIDE

STEP 4: DRAW ASYMPTOTES WITH A DOTTED LINE

STEP 1   Use the sign of "a" to locate the curves

and use the size of "a" to gauge the steepness of the curve

STEP 2   Sketch the graph

STEP 3   Label the points **x = 1** and **x = −1** as a guide to the scale of your graph

STEP 4   Draw asymptotes with a dotted line Draw **asymptotes** with **dotted** lines