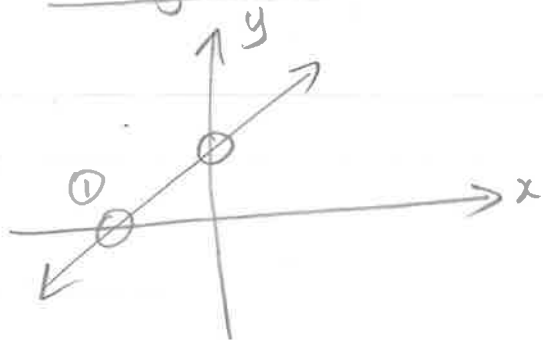# Graphs

Straight line — linear equation $y = mx + b$

need at least two points
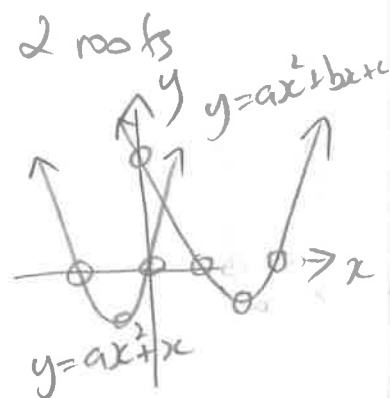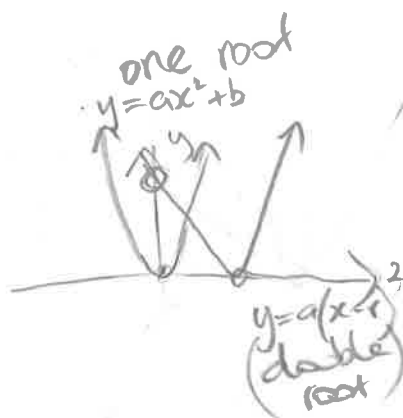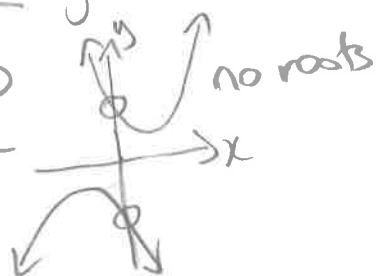
① $y = 0$ — crosses the x-axis

② $x = 0$ — crosses the y-axis (the y-intercept)

Parabola $y = ax^2 + bx + c$

① $y = 0$
roots of the equation

no roots

one root
$y = ax^2 + b$

$y = a(x-r)^2$ (double) root

2 roots
$y = ax^2 + bx + c$

$y = ax^2 + x$

② $x = 0$ — finds the y-intercept (always the constant value)

③ find the axis of symmetry — the average of the roots

$$\text{or} \rightarrow x = \frac{-b}{2a}$$

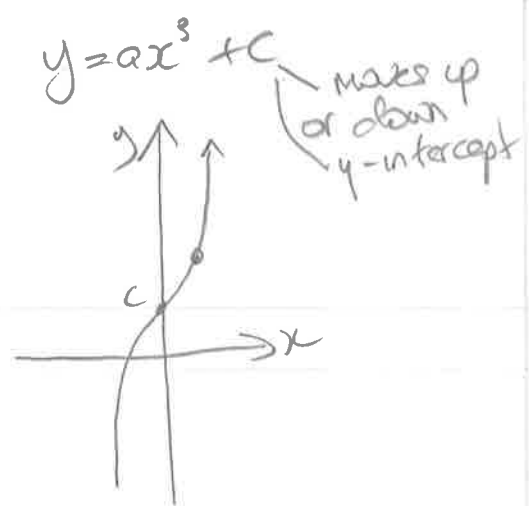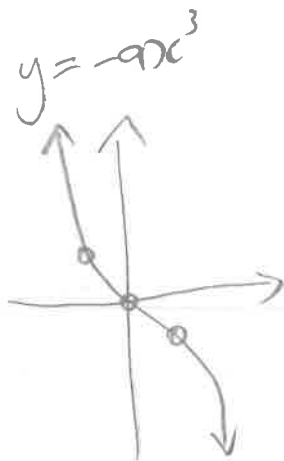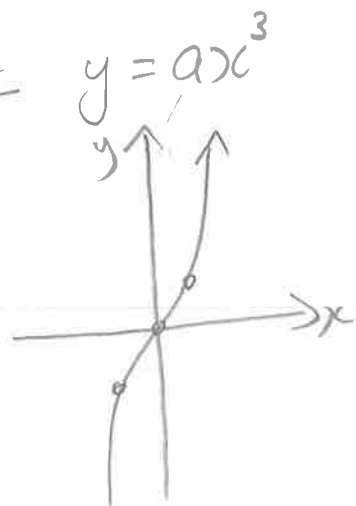④ find the vertex (point → (x, y)) sub ③ x value into the equation to find the y-value

⑤ Min or max value is the y-value of the vertex

$\cup$
$a > 0$

$\wedge$
$a < 0$

$y = ax^2 + b$
narrower or broader
up or down the y-axis

$y = a(x - r)^n$
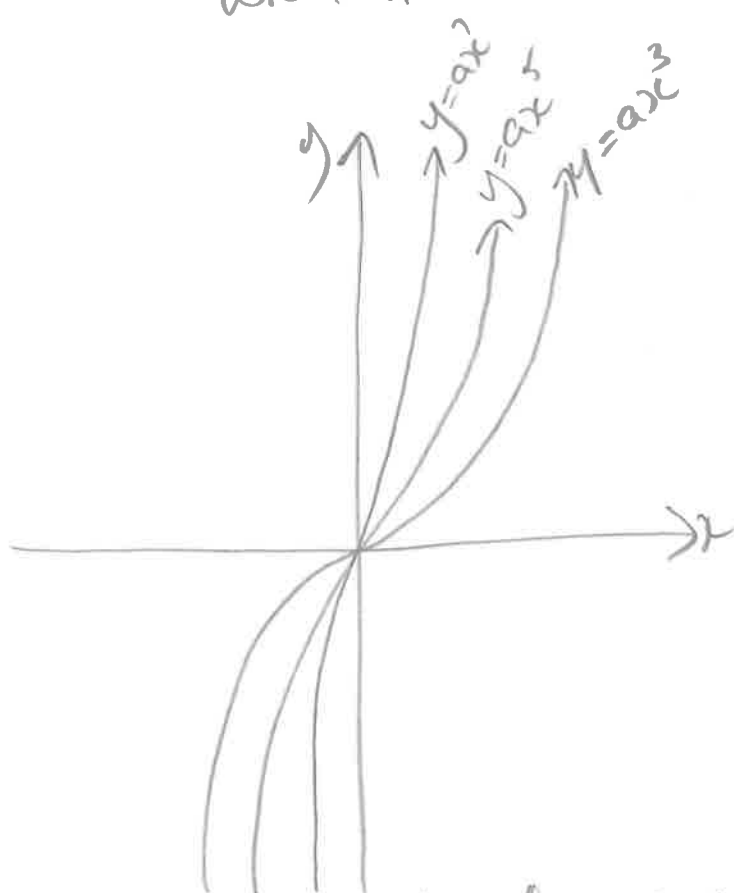narrow or broader
translates r units right or left

Cubic

$y = ax^3$

$y = -ax^3$

$y = ax^3 + c$ — makes up or down
y-intercept

c

$\underline{y = ax^n}$

when n is even

$y = ax^8$
$y = ax^6$
$y = ax^4$
$y = ax^2$

The higher the power, n,
the narrower the graph

When n is odd

$y = ax^9$
$y = ax^7$
$y = ax^5$
$y = ax^3$

The higher the power n,
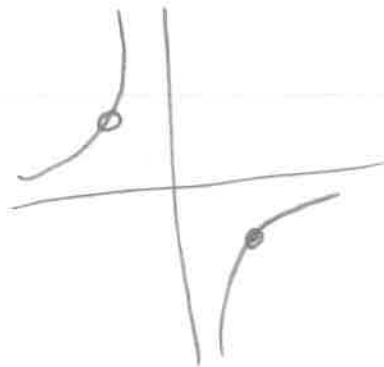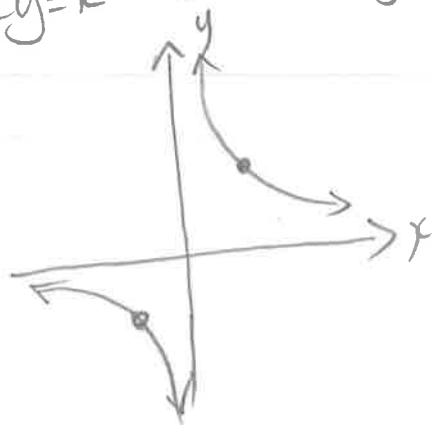the narrower the graph

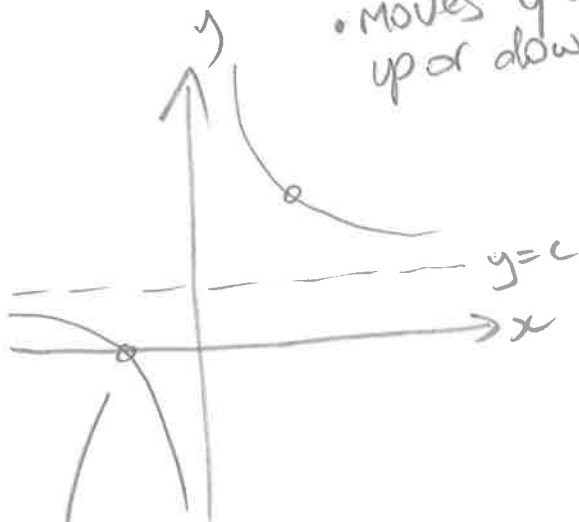# Hyperbola

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

$$xy = k$$

asymptotes $x=0$
$y=0$
$x \neq 0$
$y \neq 0$

$$y = \frac{-k}{x}$$

Label at least one point on each branch

$$y = \frac{k}{x} + c$$
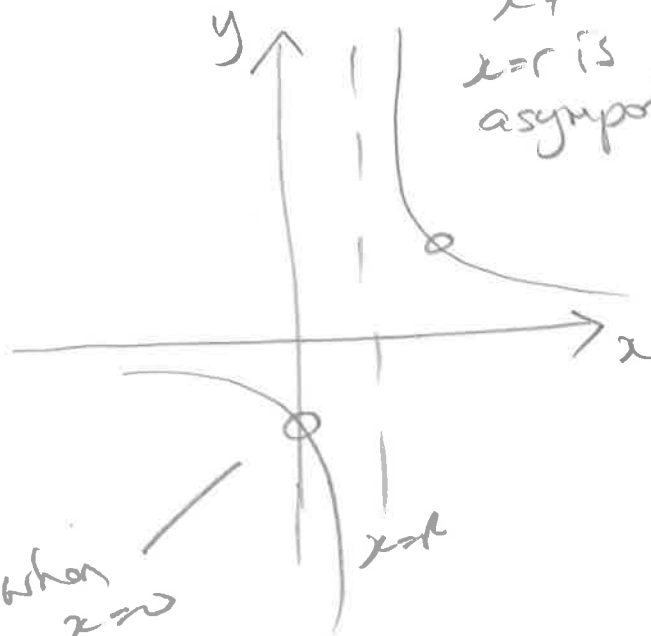
• moves graph up or down,
• moves y asymptotes up or down

$y = c$

when $y = 0$

$$y = \frac{k}{x-r}$$

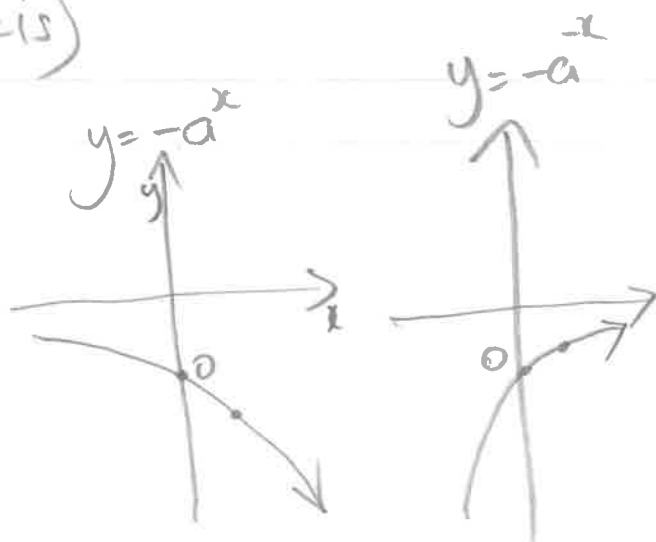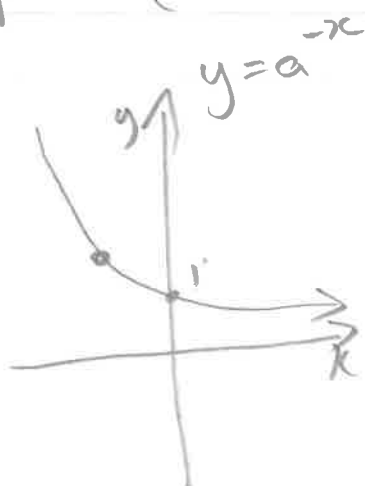$x - r \neq 0$
$x \neq r$
$x = r$ is asymptote

when $x = 0$

$x = r$

Exponential curves

$y = a^x$

$x = 0, y = 1$

$y = 0$ is asymptote (i.e. x-axis)

$y = a^x$

$y = a^{-x}$

$y = -a^x$

$y = -a^{-x}$
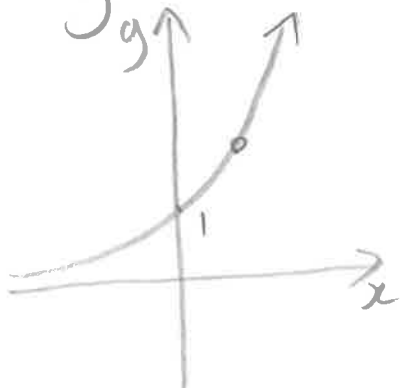
$y = a^x + c$ — moves up or down

becomes the new asympote

$y = c$
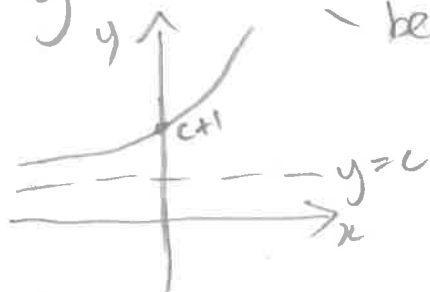
Circles

general formula

$(x - h)^2 + (y - k)^2 = r^2$
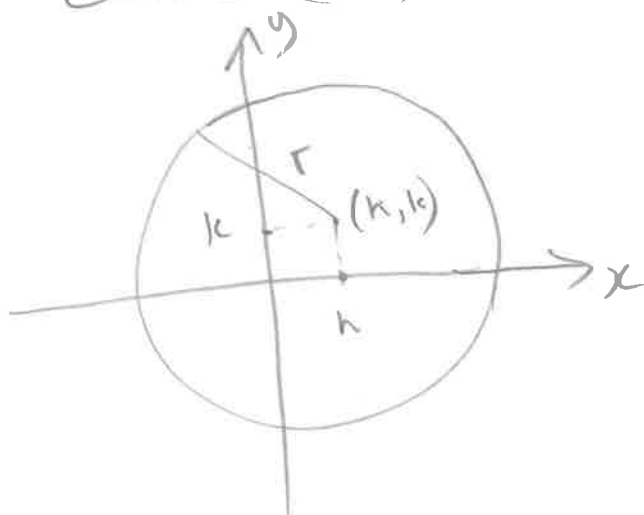
centre (h, k) radius $= r$

$x^2 + y^2 = r^2$

circle with centre $(0, 0)$

radius $= r$