On *separate* **scratch paper**:

calculate b^2-4ac . If this is a very *big* number you *may* need to use a **calculator** next.

If b^2-4ac is a **perfect square** like $\sqrt{49}=7$

If b^2-4ac is **negative** or *not* a **perfect square** such as **-3** because it's negative or **46** (because $\sqrt{46}$ doesn't "work") the **quadratic** is **prime**. **Write down** $a\cdot c$ **scribble** as if you were *trying out* **factors** of $a\cdot c$. Write "the **quadratic** is **prime**."

If $b^2-4ac=0$ just continue with the **QF** *or* save time with the **binomial theorem**

complete the **rest** of the **Quadratic Formula**.

Just take the **square root** of what you have already worked out $\sqrt{b^2-4ac}$ and since that always just gives you **D**, an **integer**, (or you should *not* have reached this **step** here). The rest is *easy*!

$$\frac{-b\pm D}{2a}$$

Do it **twice**. Once with the + and once with the **-**

These **two answers** r_1 , r_2 are called the **roots** of the **quadratic**.

recognize the **Binomial Theorem**

the **quadratic** will be of the **form**

$$a^2\pm 2ab+b^2=(a\pm b)^2$$

such as $x^2-6x+9=(x-3)^2$

write down $a\cdot(x-r_1)\cdot(x-r_1)$ and **multiply** by the **a** to get *rid* of all **fractions.**

Let's say **a=6** and $r_1=\frac{1}{2}$ **and** $r_2=\frac{1}{3}$:

$6(x-\frac{1}{2})\cdot(x-\frac{1}{3})=2\cdot(x-\frac{1}{2})\cdot 3\cdot(x-\frac{1}{3})=(2x-1)\cdot(3x-1)$ the **quadratic** is **factored**!

The *amazing* thing is this will *always* work! To see the reason/proof *why!!* **p...** It's **Group Theory**!

foil the **factored form**, but *don't* add the **x**'s together. Now you have the **correct grouping** (**trick IV**).

$$(2x-1)\cdot(3x-1)=6x^2-3x-2x+1$$

on the **answer paper**

multiply a and **c**, $a\cdot c$, and **write it down** at the top of your **answer**. Now, leave room for **scribbling**, as if you were *trying out* **factors** of $a\cdot c$. Now, **write down** the **correct grouping** from above. Below that, **write** the **factored form** of the **quadratic.** Done!

<u>On separate **scratch paper**</u>

1. **calculate** b^2-4ac . If this is a very *big* **number** you may need to use a **calculator** next.

If this **number** is **negative** or *not* a **perfect square** then the **quadratic** won't **factor** into **integers** and is called "**prime**". But, if this **number** *is* a (**non-negative) perfect square** you *will* be able to **integer factor**, and the **quadratic** is *definitely not* **prime**!

(this is *not* obvious at *all*!, **p...**)

So now you already know *whether* this is a so called "**prime**" **quadratic** or *not*!

If $b^2-4ac=0$ use $(a^2\pm 2ab+b^2)=(a\pm b)^2$ (**Binomial Theorem**) to **factor** and save **time** *or* just *continue* here and the **two roots** will be just be **equal**, see below.

2. **complete** the **rest** of the **QF** to get the **roots:** r_1 and r_2 . (each **root** should be either an **integer** or a simple **fraction** $\frac{a}{b}$)

3. **write** down $a\cdot(x-r_1)\cdot(x-r_1)$.

If r_1 and r_2 are **integers** you are *done*. Of course this means **a=1** and you should just have used **trick I**, but no harm done.

Otherwise, **break up a** into the **(number) factors** necessary to make everything **integer.** You now have the **factored form of the quadratic**. This will *always* work if you passed **step 1**.

4. **Foil** the **factored form**, but don't add the **x**'s together. Now you have the **correct grouping** for **trick IV**.

<u>On your **answer paper**</u>

5. **multiply a** and **c** and **write down** the result at the top of your **answer**. Now, leave room for scribbling as if you were **trying out factors** of $a\cdot c$ **. Write down** the **correct grouping** from **step 5**. Below that, **write** the **factored form of the quadratic.** Done!