A Number Puzzle about Planets Beyond our Solar System
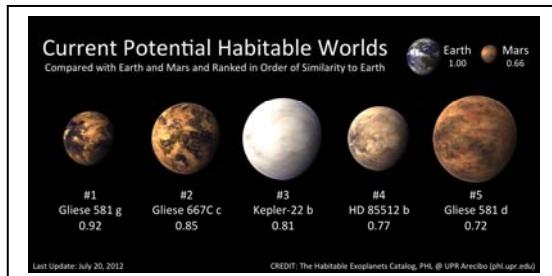
By 2013, astronomers have detected over 941 confirmed planets, and 2500 additional candidates, which orbit stars beyond our solar system. Many of these are earth-like and could have liquid water on their surfaces.

Find the roots to the quadratic equations below and match the X-value to the Word Bank to find the word to use in the essay about exoplanets.

Since 1995, astronomers have discovered over 900 planets orbiting other stars. Because they are not planets orbiting our own sun, they are called 1)_____. At first, astronomers could only detect planets that were larger than 2)_____. Those were often found orbiting their stars much closer than 3)_____ orbits our own sun. Then as instruments improved in their 4)_____, planets as large as the outer planet 5)_____ and as small as our own Earth were found. NASA's 6)_____ observatory in space was launched in 2010 and has since discovered over 2000 new candidate planets, and many of these are Earth-like in size. What is also so exciting is that 7)_____ of these earth-sized worlds orbit far enough from their stars that liquid 8)_____ can exist on their surfaces if the planets have dense-enough 9)_____.

Some exoplanets are unbelievably strange. The world orbiting the star HD209458 looks like a Jupiter-sized comet. It is so close to its star that this planet is actually evaporating. Another exoplanet called 10)_____ is located in the constellation Monoceros. It is so hot that its clouds rain droplets of liquid 11)_____ onto its surface, which is covered by a liquid lava ocean. The Hubble and 12)_____ Space Telescopes have actually seen two planets orbiting the stars 13)_____ and 14)_____ in the constellations Pisces Austrinus and Vulpecula. They are about the size of Jupiter and orbit their stars far beyond the orbit of Neptune in our solar system. One star called 15)_____ located 127 light years from Earth in the constellation Hydrus, has seven planets but they all orbit closer to their star than Mars in our own solar system. Five of these planets are as big as Neptune!

1) x^2-2x-3
2) x^2-16
3) $x^2+3x-10$
4) $2x^2-6x$
5) $3x^2-12$
6) $5x^2+30x-35$
7) $x^2-13x+36$
8) $2x^2-12x+10$

9) $4x^2-8x-12$
10) $x^2+4x-12$
11) $x^2+11x+30$
12) $x^2-13x+42$
13) $x^2-16X+63$
14) $3x^2+24X-27$
15) $2x^2-12x-32$

Word Bank

+3 exoplanets	0 sensitivity	-2 Neptune
-1 atmospheres	-7 Kepler	+1 water
+8 HD10180	+9 many	+4 few
-4 Jupiter	+5 oxygen	-6 CoRot7b
-5 iron	+6 Spitzer	+7 Fomalhaut
+2 Mercury	-9 HD189733	+10 methane

Since 1995, astronomers have discovered over 900 planets orbiting other stars. Because they are not planets orbiting our own sun, they are called 1)___**exoplanets**__. At first, astronomers could only detect planets that were larger than 2)_____**jupiter**__. Those were often found orbiting their stars much closer than 3)__**mercury**__ orbits our own sun. Then as instruments improved in their 4)__**sensitivity**__, planets as large as the outer planet 5)__**Neptune** and as small as our own Earth were found. NASA's 6)_**Kepler**__ observatory in space was launched in 2010 and has since discovered over 2000 new candidate planets, and many of these are Earth-like in size. What is also so exciting is that 7)__**many**__ of these Earth-sized worlds orbit far enough from their stars that liquid 8)__**water**_ can exist on their surfaces if the planets have dense-enough 9)__**atmospheres**__.

Some exoplanets are unbelievably strange. The world orbiting the star HD209458 looks like a Jupiter-sized comet. It is so close to its star that this planet is actually evaporating. Another exoplanet called 10)__**CoRot7b**__ is located in the constellation Monoceros. It is so hot that its clouds rain droplets of liquid 11)__**iron** onto its surface, which is covered by a liquid lava ocean. The Hubble and 12)__**Spitzer**__ Space Telescopes have actually seen two planets orbiting the stars 13)_**Fomalhaut**__ and 14)__**HD189733**__ in the constellations Pisces Austrinus and Vulpecula. They are about the size of Jupiter and orbit their stars far beyond the orbit of Neptune in our solar system. One star called 15)_**HD101080**__ located 127 light years from Earth in the constellation Hydrus, has seven planets but they all orbit closer to their star than Mars in our own solar system. Five of these planets are as big as Neptune!

1)	x^2-2x-3	: (x-3)(x+1)	x = +3, x= -1	**exoplanet**, atmospheres
2)	x^2-16	: (x-4)(x+4)	x= +4 , x=-4	few, **jupiter**
3)	$x^2+3x-10$	: (x+5)(x-2)	x=-5, x=+2	iron, **mercury**
4)	$2x^2-6x$	: x(2x-6)	x=0, x=+3	**sensitivity**, exoplanets
5)	$3x^2-12$	: (3x-6)(x+2)	x=+2, x=-2	mercury, **neptune**
6)	$5x^2+30x-35$	: (5x-5)(x+7)	x=-7, x=+1	**Kepler**, water
7)	$x^2-13x+36$	: (x-9)(x-4)	x=+9, x=+4	**many**, few
8)	$2x^2-12x+10$	: (2x-2)(x-5)	x=+1, x=+5	**water**, oxygen
9)	$4x^2-8x-12$	: (x+1)(4x-12)	x=-1, x=+3	**atmosphere**s, exoplanets
10)	$x^2+4x-12$	: (x+6)(x-2)	x=-6, x=+2	**CoRot7b**, mercury
11)	$x^2+11x+30$	: (x+5)(x+6)	x=-5, x=-6	**iron**, CoRot7b
12)	$x^2-13x+42$	: (x-6)(x+7)	x=+6, x=-7	**Spitzer**, Kepler
13)	$x^2-16X+63$	: (x-7)(x-9)	x=+7, x=+9	**Fomalhaut**, many
14)	$3x^2+24x-27$	: (3x+27)(x-1)	x=-9, x+1	**HD189733**, water
15)	$2x^2-12X-32$	: (2x-16)(x+2)	x=+8, x=-2	**HD10180**, neptune