**Question 5**

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**(a)**

We can derive the relationship betweenandby computing **.**

Since **, ,** and **.**

Then we have

**.**

Thus, the growth rate of is greater than that of

***.***

So (II) fits this pair of functions.

**(b)**

We can derive the relationship betweenandby computing **.**

Since **,** and **.**

Then we have

**= (diverges)**

图表

描述已自动生成

When we look at the graph of this equation, we see that:

When is odd, the limit tends to 0, and at this point is the upper bound of .

When is even, the limit tends to infinity, and at this point is the upper bound of .

So, the relationship between this pair of functions is unstable, then only (IV) fits this scenario.

**(c)**

We can derive the relationship betweenandby computing **.**

Since **, ,** and **.**

Then we have

**.**

Since

**,**

**.**

Thus

**.**

Because **,** there will be a positive constant and make**.** Therefore, we can tell that .

Moreover, then approach to infinity, the value of the above polynomial is close to . In this case, we can tell that **.**

Thus, only (III) fits this scenario, and the relationship between this pair of functions is **.**