1.9

We know

Take the second derivative, we have

if x >= 0, 6x is always >=0. In this case, is convex for x >= 0

2.

So which is , so in this case, is convex

3.

We know f and g are both convex, so f’’ and g’’ are both >= 0

For , the second derivative of it is , so in this case and is convex.

4.

We know that *f* and *g* have same minimum point, and since both *f* and *g* are convex, so *f’(x\_min)* and *g’(x\_min)* both equals to 0.

If we take another point *x*, for *x* < *x\_min*, then *f’(x\_min)* and *g’(x\_min)* both < 0*.*

If we take another point *x*, for *x > x\_min*, then *f’(x\_min)* and *g’(x\_min)* both > 0*.*

In this case, no matter what situation,

will always > 0.

For the second derivative

Since we know that *f* and *g* are non-negtive on *S* and *f’’(x)* and *g’’(x) are non-negative.*

So . In this case is convex