

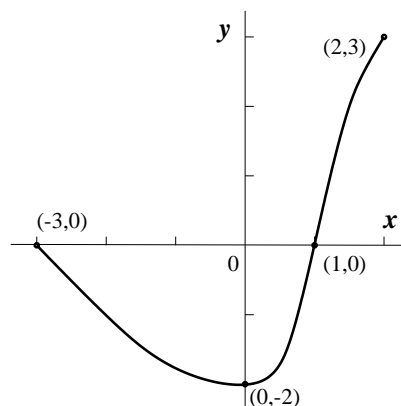
1. A graph of $y = A(x)$ is shown to the right. Answer the following questions as well as you can.

a) What are the domain and range of A ?

b) If B is the function defined by $B(x) = A(x) + 1$, sketch the graph of B as well as you can. What are the domain and range of B ?

c) If C is the function defined by $C(x) = A(x)^2$, sketch the graph of C as well as you can. What are the domain and range of C ?

d) If D is the function defined by $D(x) = \frac{1}{A(x)}$, sketch the graph of D as well as you can. What are the domain and range of D ?



2. If an example of any of the following exists, describe the example and explain why it fulfills the requirements. Sketch a graph of the example. If an example doesn't exist, explain why no such example exists.

a) A polynomial whose roots are exactly the numbers 1, -2 and 3.475.

b) A polynomial whose roots are exactly the numbers 1, -2 and 3.475 and whose non-zero values are always positive.

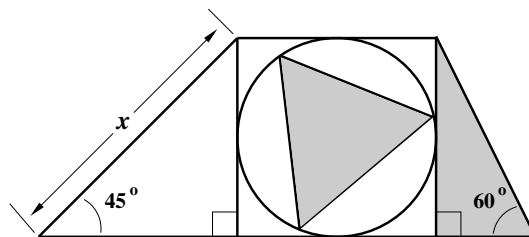
c) A polynomial whose roots are exactly the numbers 1, -2 and 3.475 and which has degree 100,000.

d) A polynomial whose roots are exactly the numbers 1, -2 and 3.475 and which has degree 100,000 and whose non-zero values are always positive.

e) A polynomial whose roots are exactly the numbers 1, -2 and 3.475 and which has degree 57 and whose non-zero values are always positive.

3. The picture shows an isosceles right triangle with hypotenuse of length x (a positive real number). A side of the triangle is a side of a square. A circle is inscribed in the square, and an equilateral triangle is then inscribed in that circle. Another side of the square is the longer side of a 30-60-90 right triangle. The *sum* of the areas of the triangle inside the circle and of the 30-60-90 right triangle is a function of x .

Find this function. Explain how you obtained your answer in *complete sentences*.



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4. a) Fill in the boxes below with the numbers 10^{-10} , -10^{10} , 10^{10} , and -10^{-10} so that the resulting statement is true.

$$\square < \square < \square < \square$$

b) For which numbers, w , is $w < \frac{1}{w}$? For which numbers, w , is $w < w^2$? For which numbers, w , is $w < -w$? For which numbers, w , is $-w < \frac{1}{w}$?

c) For which numbers, w , is $w^2 - 5w + 2 < w^4 - 17w^3 + 9w^2 + 4w + 1$?

5. a) Sketch a graph of $y = |x - |x - 3||$.

b) Give a “piecemeal” definition of the function whose graph was sketched in a) *without* mentioning absolute value. The graph may help to answer this question, but you should justify your answer algebraically with a case-by-case argument from the equation for y (of the sort “when $x \geq 3$ then y is given by the formula ...”).