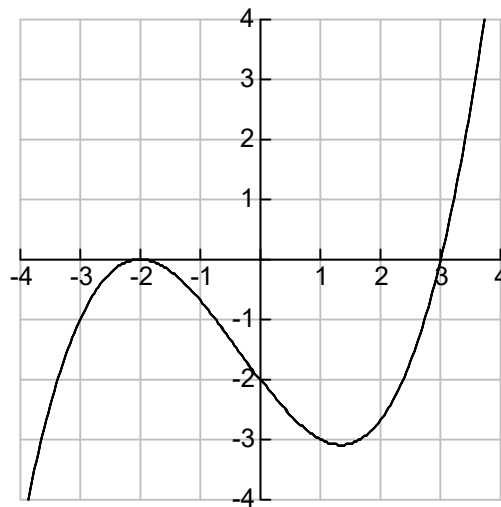


1. When a polynomial $P(x)$ is divided by $2x + 1$, the quotient is $x^2 - x + 4$, and the remainder is 3. Find $P(x)$ in simplified form.

2. Write an equation of the cubic function whose graph is given below.



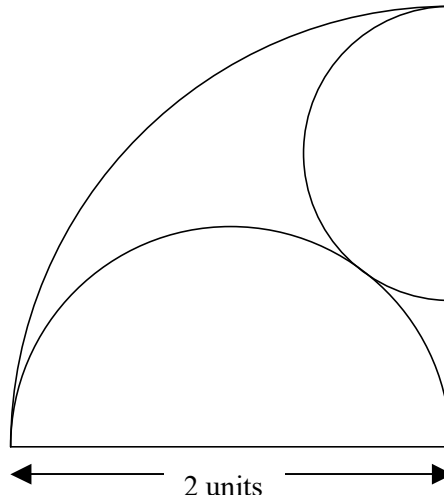
3. Find $\sqrt{a+b+c}$ where

a = the number of *real* roots of the equation $32x^4 - 2 = 0$,

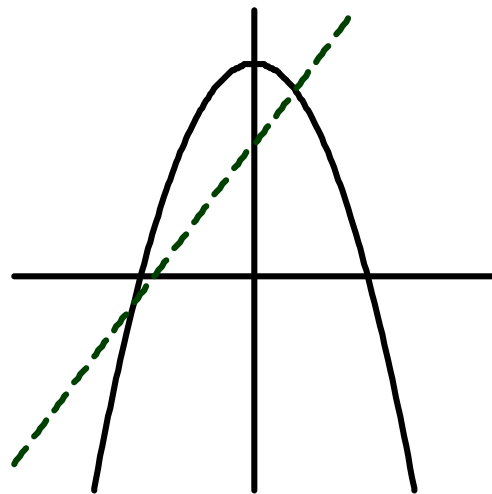
$b = (m + n)^4$ where $m^2 + n^2 = 8$ and $mn = 2$,

$c = (2\sqrt{7} + \sqrt{5})(2\sqrt{7} - \sqrt{5})$

4. The radius of the quadrant of a circle is 2 units, and the diameter of the large semicircle is also 2 units. Find the radius of the small semicircle.

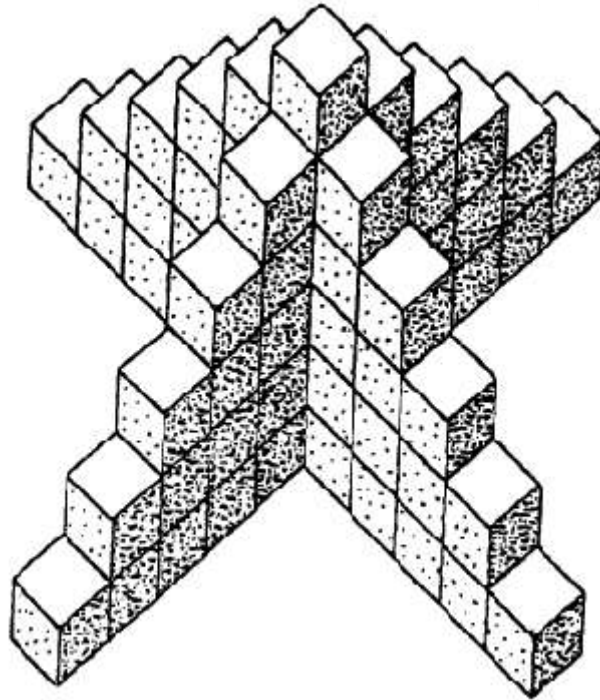


5. The line with equation $y = 2x + 5$ intersects the parabola $y = 8 - x^2$ at two points. Find the distance between these points.



6. Give all values of x for which the following inequality is true.
$$25^x < 6 \times 5^x - 5$$

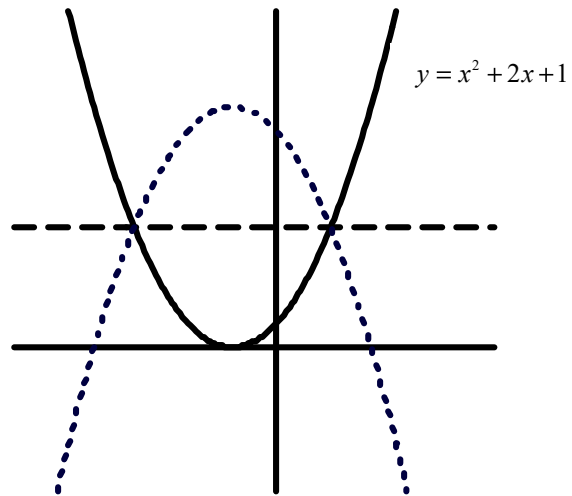
7. Find the total number of blocks needed to build a tower of n blocks of the type shown below.



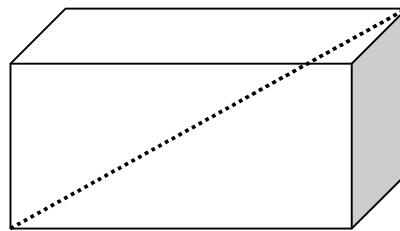
8. A train is travelling at 108 km/h. The last wagon leaves a 1 km tunnel 1 minute after the train enters the tunnel. How long is the train?
9. A garden in the shape of a right triangle has sides measuring 60 m, 80 m, and 100 m. A fence runs from the vertex of the right angle to the hypotenuse and separates the garden into two parts of equal perimeter. Find the length of this fence.

10. Pythagorean Triples are sets of three integers which satisfy Pythagoras Theorem. The smallest of each of 4 sets is given below. Generate the remaining two integers for each and find the sum of the resulting 8 integers.
- 3, __, __ ;
- 5, __, __ ;
- 7, __, __ ;
- 8, __, __.
11. A square of perimeter 20 is inscribed in a square of perimeter 28. What is the largest distance between a vertex of the inner square and a vertex of the outer square?
12. Two identical sheets of metal, 11 cm by 14 cm, are rolled into cylinders, one with height 11 cm, and the other with height 14 cm. What is the difference in volume between the two cylinders?

13. The graph of the function
 $y = x^2 + 2x + 1$
is reflected in the line $y = 5$.
What is the equation of its
image?



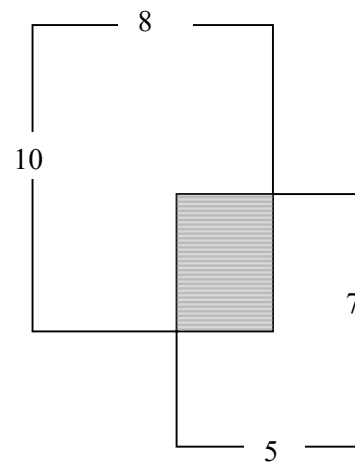
14. The length of a rectangular parallelepiped is twice the width, and the width is twice the height. If a space diagonal is 42 cm, find the volume. A space diagonal does not lie on any of the sides – it joins two opposite vertices of the parallelepiped.



15. Peter and Boris are two tennis players to play in a series of five games. Each has an equal chance of winning any game. The player that wins three games first wins the tournament. If Peter has won the first game, what is the probability that he wins the series?

16. Find n , the smallest positive integer satisfying the following conditions:
 $n > 7$
 n is divisible by 5, $n + 1$ is divisible by 6, and $n + 2$ is divisible by 7.

17. A rectangle with dimensions 10 cm by 8 cm is constructed. Another rectangle with dimensions 7 cm by 5 cm is constructed and overlaps the first as shown. What is the *absolute* value of the difference between the two *non-overlapping* regions of the rectangles?



18. A sequence is formed as follows

$$3^2 + 4^2 = 5^2$$

$$5^2 + 12^2 = 13^2$$

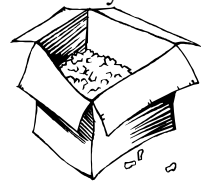
$$13^2 + n^2 = (n+1)^2$$

$$(n+1)^2 + m^2 = (m+1)^2$$

Find $m + n$

19. If $f(x) = f(x-1) + x^2$, and $f(3) = 7$, evaluate $f(1) + f(5)$.

20. Two bags are labelled A and B. Bag A contains 3 black and 2 white balls. Bag B contains 1 black and 3 white balls. I choose a bag at random and take out a ball. I then choose a bag at random again and take out another ball. What is the probability that the two balls in my hand are different colours?



21. During practice a driver hopes to complete two laps of a track at an average speed of 150 km/h. At the end of the first lap his average speed is 100 km/h. At what speed must he complete the second lap in order to achieve his aim?

