Melbourne High School

MAV Maths Games Day and SEHS Maths Games Day Selection Test 2023

Questions 1–6 require only a numerical answer. Write it in the box provided at the bottom of the page. Questions 7–8 require a written response.

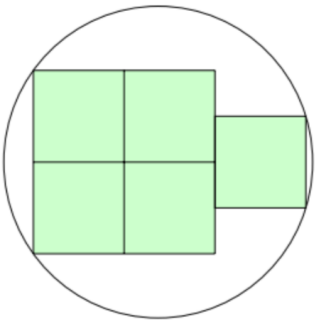
Name and form: _____

1. (2 points) Given that x and y are both integers and $2^{x+1} + 2^x = 3^{y+2} - 3^y$, what is the value of $x + y$?

2. (2 points) The 5-digit number $P679Q$ is divisible by 72. What is the digit P equal to?

3. (2 points) Consider a cube of edge 9 cm. In the centre of three different and not opposite faces a square hole is made which goes through to the opposite face. Each side of each hole has width 3 cm. What is the surface area, in cm^2, of the remaining solid?

4. (3 points) Five squares of unit area are circumscribed by a circle as shown. What is the radius of the circle?



5. (3 points) Jan and Jill are both on a circular track. Jill runs at a steady pace, completing each circuit 72 seconds. Jan walks at a steady pace in the opposite direction and meets Jill every 56 seconds. How long does it take Jan to walk each circuit?

6. (3 points) Quadratic polynomials $P(x)$ and $Q(x)$ have leading coefficients 2 and -2, respectively. The graphs of both polynomials pass through the points $(16, 54)$ and $(20, 53)$. Find $P(0) + Q(0)$.

7. (4 points) Show that $n^4 - 20n^2 + 4$ is composite for all integers n, where $n > 4$.

8. (5 points) Consider a polyhedron whose faces are convex polygons. Show that it has at least two faces with the same number of edges.

Question	1	2	3	4	5	6
Answer						

Total marks: /24