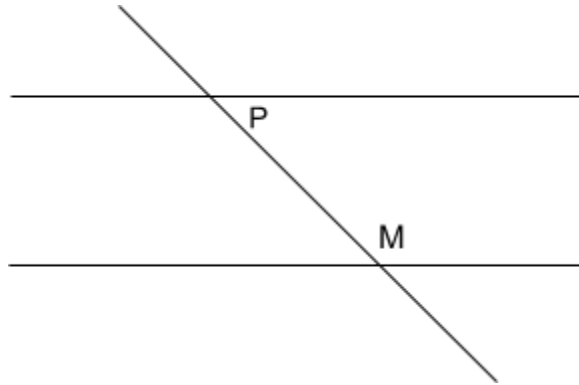


1. Josh the jokester loves making math jokes. He points at a miscellaneous two-dimensional shape and says that it is “pointless”. Which shape is he referring to?
 - a. Cylinder
 - b. Sphere
 - c. Square
 - d. Triangle
 - e. **NOTA**
2. Which of the following terms is NOT a unit used to measure angles?
 - a. Radians
 - b. Minutes
 - c. Seconds
 - d. Revolutions
 - e. **NOTA**
3. Consider the following statement: because $a = b$ and $b = c$, $a = c$. If this statement is correct, which property is demonstrated?
 - a. Reflexive property of equality
 - b. Commutative property of equality
 - c. **Transitive property of equality**
 - d. Locomotive property of equality
 - e. NOTA
4. If the apothem of a dodecagon is 12 cm and the length of one side is 10 cm, what is the figure’s area in square cm?
 - a. **720**
 - b. 1440
 - c. 72
 - d. 144
 - e. NOTA
5. An isosceles trapezoid WXYZ has coordinates at (3, 2), (7, 2), (4, 5), and (6, 5), respectively. It is rotated 90 degrees counterclockwise about the origin. What is the coordinate of W’?
 - a. **(-2, 3)**
 - b. (-3, 2)
 - c. $(\frac{1}{2}, \frac{1}{3})$
 - d. $(-\frac{1}{2}, \frac{1}{3})$
 - e. NOTA
6. What is the ratio of any given sphere’s volume to its surface area, in terms of its radius?
 - a. $6r$
 - b. $2r$
 - c. $\frac{1}{6}r$

- d. $\frac{1}{3}r$
 e. NOTA
7. Find the area of the triangle formed by the graphs $x = |y - 3| + 5$ and $x = 8$. (All answers are in square units).
- a. **9**
 b. 10
 c. 11
 d. 12
 e. NOTA
8. A right circular cone is held upside-down with its tip pointing towards the ground. Water is poured into the cone at a rate of $3 \text{ cm}^3/s$. If the cone's radius is 3 cm and the triangular cross-section of the cone has an area of 6 cm^2 , how many seconds will the water fill until the cone cup overflows? Round your answer to the nearest second and use $\frac{22}{7}$ to approximate π .
- a. $\frac{262}{7}$
 b. $\frac{264}{7}$
 c. $\frac{98}{7}$
 d. $\frac{108}{7}$
 e. NOTA
9. Thomas the beta fish lives in a glass fish tank shaped as a rectangular prism. The base of the fish tank is 1.75m long and 1.25m wide, while the height of the tank is 1m. Given that the volume of water in the tank is 1.5 m^3 , find the volume of the glass that makes up the tank alone to the nearest tenth of a cubic meter.
- a. 0.4
 b. 0.5
 c. 0.6
 d. **0.7**
 e. NOTA
10. Anna the box turtle has a shell with a cross section of an isosceles trapezoid. If the shortest of the two parallel sides is 3 cm long, the two sides of equal length are 4 cm long, and the angle between these two sides is $\frac{2\pi}{3}$ radians in measure, how long is a diagonal across Anna's shell? Express your answer in simplest radical form.
- a. $4\sqrt{2}$
 b. $3\sqrt{4}$
 c. $\sqrt{29}$
 d. $\sqrt{37}$
 e. NOTA

11. Charlie measures two angles on his perfectly triangular slice of pizza. Angle $\angle A$ measures 34° and angle $\angle B$ measures 68° . Find the measure of the third angle in degrees.
- a. **78**
 - b. 88
 - c. 98
 - d. 108
 - e. NOTA
12. Find the perimeter of a triangle with side length 3 and with angles whose cosines are all $\frac{1}{2}$.
- a. $\frac{9}{2}$
 - b. **9**
 - c. $\frac{27}{2}$
 - d. 18
 - e. NOTA
13. Consider the function $f(x) = x^{2n}$, with n approaching infinity. Assuming the graph becomes a figure with two right angles at $(-1, 0)$ and $(1, 0)$, find the volume of the solid bounded by $f(x)$ and $y = 4$ (assumed perpendicular to the verticals) and revolved about $x = 4$. Answer in terms of π ; all answers are in units cubed. (Hint: elongated doughnut).
- a. 16π
 - b. 32π
 - c. 48π
 - d. **64π**
 - e. NOTA
14. Ami is flying through Flavortown to find her friend Guy Fieri. If Ami is located at point $(2, 13, 5)$, and Guy Fieri is at point $(8, 25, 9)$, find the shortest possible distance between the two best buddies.
- a. 6
 - b. 7
 - c. **14**
 - d. 169
 - e. NOTA
15. If $\angle P$ is 32° , what is the measure of $\angle M$ in radians?



- a. $\frac{\pi}{18}$
 - b. $\frac{\pi}{17}$
 - c. $\frac{38\pi}{47}$
 - d. $\frac{37\pi}{45}$
 - e. NOTA
16. A rectangle has a perimeter of 84. If the length is 6 times the width, what is the length of the rectangle?
- a. 6
 - b. 14
 - c. **36**
 - d. 72
 - e. NOTA
17. Find the converse of the inverse of the contrapositive of the following statement:
If Declan diets for a month, Declan will lose weight.
- a. **If Declan diets for a month, Declan will lose weight.**
 - b. If Declan does not diet for a month, Declan will not lose weight.
 - c. If Declan does lose weight, then Declan dieted for a month.
 - d. If Declan does not lose weight, then Declan did not diet for a month.
 - e. NOTA
18. Find the area of a kite whose diagonals are 4 and 7.
- a. 12
 - b. 13
 - c. **14**
 - d. 15
 - e. NOTA
19. Consider the points A (2, 3) and B (-8, 23). Find the coordinates of the midpoint of segment AB.
- a. **(-3, 13)**

- b. (13, -3)
- c. (12.5, -6.5)
- d. (6.5, -12)
- e. NOTA

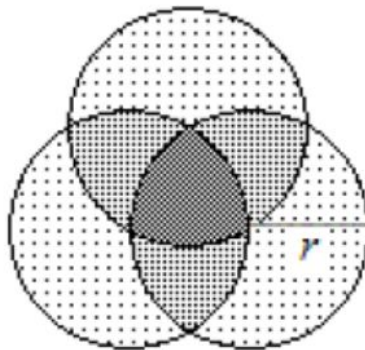
20. What is the angle between the hour and minute hands on an analog clock at 6:40 in radians?

- a. $\frac{\pi}{9}$
- b. $\frac{2\pi}{9}$**
- c. $\frac{\pi}{3}$
- d. $\frac{2\pi}{3}$
- e. NOTA

21. What is the maximum number of points at which 4 distinct lines can intersect?

- a. 6**
- b. 7
- c. 8
- d. 9
- e. NOTA

22. Three circles have a radius of r . They all intersect each other as shown in the figure below such that each circle passes through the center of the other two circles. What is the area of region covered by all three circles (the darkest shaded region), in terms of π and r ?



- a. $\frac{\pi - \sqrt{3}}{4} r^2$
- b. $\frac{\pi + \sqrt{3}}{4} r^2$
- c. $\frac{\pi - \sqrt{3}}{2} r^2$**
- d. $\frac{\pi + \sqrt{3}}{2} r^2$
- e. NOTA

23. What is the y-intercept of the line passing through the points of intersection of circles $(x - 3)^2 + (y + 2)^2 = 4$ and $(x - 3)^2 + (y + 4)^2 = 4$?
- 9
 - 3**
 - 3
 - 9
 - NOTA
24. The vertex of the function $y = (x - \frac{\pi}{2})^2 + 3$ corresponds to the radius and central angle of a circle sector, with the x coordinate of the point representing the central angle in radians and the y coordinate representing the radius. What is the area of this sector, in terms of π ?
- $\frac{3\pi}{4}$
 - $\frac{3\pi}{2}$
 - $\frac{9\pi}{2}$
 - $\frac{9\pi}{4}$**
 - NOTA
25. If a circle's circumference is growing at a constant rate of 2 cm/s and the radius of the circle is 7 cm when $t = 0$, what will its area be at $t = 10$ in cm^2 and in terms of π ?
- $\frac{100}{\pi}$
 - $\frac{10}{\pi}$
 - 100π
 - 10π
 - NOTA
26. A triangle formed by the lines $y = x$, $x = 1$, and the x-axis is revolved about the y-axis to form a three-dimensional solid. What is its volume, in cubic units and in terms of π ?
- $\frac{1}{4}\pi$
 - $\frac{1}{3}\pi$**
 - $\frac{1}{2}\pi$
 - π
 - NOTA
27. In a triangle with radius 1 and containing angle θ , which of the following statements is false?
- $(\sin\theta)^2 + (\cos\theta)^2 = 1$
 - $(\tan\theta)^2 + 1 = \frac{1}{(\cos\theta)^2}$
 - $\frac{\tan\theta \cos\theta}{\sin\theta} = 1$
 - $\sin\theta + \cos\theta = \tan\theta$**
 - NOTA

28. The coordinates of two opposite vertices of a rhombus are (3, 2) and (8, 12). What is the slope of the diagonal between the other two unlisted vertices?
- a. 2
 - b. -2
 - c. $-\frac{1}{2}$
 - d. $\frac{1}{2}$
 - e. NOTA
29. Jimmy is preparing lemonade for a party this weekend. He made way too much lemonade, but does not want the serving dish he keeps the lemonade in to look too big, fearing potential ridicule from partygoers. In order to avoid being made fun of, help him select one of the following shapes that has the highest volume to surface area ratio, regardless of actual capacity.
- a. **Semicircular soup bowl**
 - b. Cylindrical sippy cup
 - c. Cubical container
 - d. Pyramidal pyrex
 - e. NOTA
30. Congratulations! You have reached the end of a truly difficult test. One last question: how many sides does a regular polygon with an exterior angle measure of 0.36° have?
- a. 1×10^1
 - b. 1×10^2
 - c. 1×10^3
 - d. 1×10^4
 - e. NOTA