1) Simplify. $(1 + i)^{20}$.

A) $-1024i$ B) $1024i$ C) -1024 D) 1024 E) NOTA

2) This famous mathematician's last theorem was finally proved about 330 years after his death.

A) Pierre de Fermat B) Leonhard Euler
C) Sir Isaac Newton D) Pythagoras of Samos E) NOTA

3) Hilary, Dana, Laura, and Michelle are sitting together at lunch. What is the probability that at least two of the four girls were born on the same day of the week?

A) $\dfrac{6}{343}$ B) $\dfrac{24}{343}$ C) $\dfrac{120}{343}$ D) $\dfrac{223}{343}$ E) NOTA

4) Given the equation $ax^2 + ax + a + bx + b + cx^2 + 10x^2 - 2x + 2c = 8x^2 - 3x - 11$, find $4a + b - c$.

A) 13 B) 3 C) 0 D) -6 E) NOTA

5) An hourglass (shaded region of the diagram) sits inside of a cylinder whose diameter is 6" and height is 10". The height of each cone is 5". Find the volume of the space outside of the hourglass and inside of the cylinder.

A) 120π cm^3
B) 90π cm^3
C) 60π cm^3
D) 30π cm^3
E) NOTA

10

6
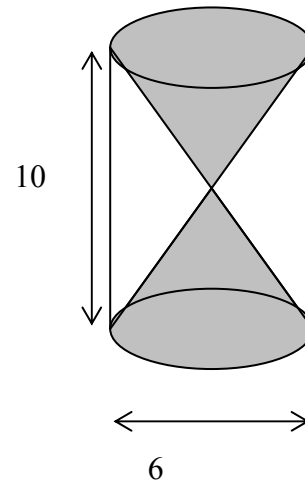
6) Find the area of the figure whose equation is $25x^2 + 4y^2 - 150x + 32y + 189 = 0$.

A) 4π units^2 B) 10π units^2 C) 25π units^2 D) 100π units^2 E) NOTA

7) Find the remainder when $x^{2006} + 1$ is divided by $x + 1$.

A) -2005 B) 2 C) 0 D) 2007 E) NOTA

8) Find the number of proper subsets of the set $\{a, b, c, d, e, f\}$.

A) 6 B) 63 C) 64 D) 65 E) NOTA

9) Find the equation of the line that passes through the center points of the graphs of $25x^2 + 9y^2 - 200x + 18y + 184 = 0$ and $9x^2 - 4y^2 + 90x + 32y + 197 = 0$.

A) $5x + 9y = 11$ B) $5x + 9y = -11$ C) $5x - 9y = 11$ D) $5x - 9y = -11$ E) NOTA

10) The cement block below, measuring 30 cm long by 20 cm wide by 20 cm high has two rectangular prisms cut out of it (as shown). Each rectangular prism cut out measures 10 cm long by 10 cm wide by 20 cm high. If cement weighs 1700 kg per cubic meter, how much does the cement block weigh?

20 cm

20 cm

30 cm
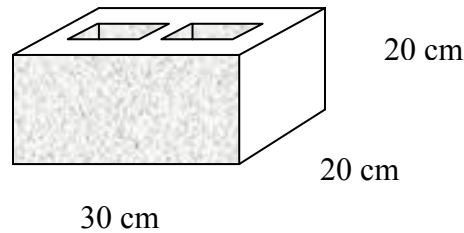
A) 13,600 kg   B) 8000 kg   C) 13.6 kg   D) 8 kg   E) NOTA

11) Carolyn decides it's time to liven things up at the house and buy parakeets. Carolyn wanders over to Burdick's Bird Boutique and purchases two green feathered parakeets, a male and a female. Carolyn wants a baby parakeet, but one that is yellow feathered. She recalls from her Biology class the topic of dihybrid crossing. Carolyn knows that common parakeets have genes that can produce four feather colors : green (BBCC, BBCc, BbCC, or BbCc), blue (BBcc or Bbcc), yellow (bbCC or bbCc) or white (bbcc). Fill out the Punnett square below to help you find the probability Carolyn's baby bird will have yellow feathers.

---------------	BC	Bc	bC	bc
BC				
Bc				
bC				
bc				

A) $\dfrac{15}{16}$ B) $\dfrac{13}{16}$ C) $\dfrac{3}{16}$ D) $\dfrac{1}{16}$ E) NOTA

12) Convert 342_7 to binary.

A) 177_2 B) 1111_2 C) 10110001_2 D) 101010110_2 E) NOTA

13) Welcome to beautiful Colorado, home of the Denver Broncos (National Football League), the Denver Nuggets (National Basketball Association), and the Colorado Rockies (Major League Baseball). Jarrod goes out and surveys a number of Colorado citizens and finds out the following information : 69 of these people are Broncos fans, 50 are Nuggets fans, 55 are Rockies fans, 26 are fans of both the Broncos and the Nuggets, 15 are fans of both the Nuggets and the Rockies, 27 are fans of both the Broncos and the Rockies, 11 are fans of all three teams, and 33 people are fans of none of these teams. How many people in all did Jarrod survey?

A) 290   B) 257   C) 150   D) 117   E) NOTA

14) The Tyler Comet is entering the plane of our solar system following a parabolic path defined by $y = 3x^2 + 24x + 50$. The sun is at the focus of the parabola. Find the coordinates of the sun based on this information.

A) $\left(4, -2\dfrac{1}{12}\right)$ B) $\left(4, -1\dfrac{11}{12}\right)$ C) $\left(-4, 1\dfrac{11}{12}\right)$ D) $\left(-4, 2\dfrac{1}{12}\right)$ E) NOTA

15) Won hiked from his camp site 12 kilometers due north, then 6 kilometers due east, then 18 kilometers due north, then 2 kilometers due east, then 10 kilometers due north, and finally 1 kilometer due east. How far was he from his camp site at the end of his hike?

A) 49 km   B) 41 km   C) 40 km   D) 24.5 km   E) NOTA

16) Given the arithmetic sequence $81\frac{2}{7}$, a, b, c, d, $103\frac{3}{7}$, find $a + b + c + d$.

A) $4\frac{3}{7}$ B) $214\frac{1}{7}$ C) $369\frac{3}{7}$ D) $1996\frac{9297}{25000}$ E) NOTA

17) Find the constant term in the expansion of $\left(x^4 + \frac{1}{x^3}\right)^7$.

A) 1   B) 35   C) 210   D) 840   E) NOTA

18) What letter of the English alphabet does the graph of $|y| = \frac{1}{2}|x-1|$ look like?

A) W   B) V   C) sideways V   D) X   E) NOTA

19) Rationalize $\dfrac{10}{\sqrt[3]{2} - \sqrt[3]{7}}$.

A) $-2\sqrt[3]{4} - 2\sqrt[3]{14} - 2\sqrt[3]{49}$ B) $2\sqrt[3]{4} + 2\sqrt[3]{14} + 2\sqrt[3]{49}$

C) $-2\sqrt[3]{2} - 2\sqrt[3]{7}$ D) $2\sqrt[3]{2} + 2\sqrt[3]{7}$ E) NOTA

20) Find the sum of the solutions for $\log_5(p^2 - 2) = \log_5 p$.

A) 0   B) 1   C) 2   D) 3   E) NOTA

21) Consider a regular convex octagon. Let A be the measure of any one interior angle and let D be the number of diagonals for the regular convex octagon. Find $A + D$.

A) 65   B) 85   C) 155   D) 175   E) NOTA

22) If $A = \begin{bmatrix} 4 & -2 \\ -3 & 3 \end{bmatrix}$, find A^{-1}.

A) $\begin{bmatrix} \frac{1}{2} & \frac{1}{3} \\ \frac{1}{2} & \frac{2}{3} \end{bmatrix}$ B) $\begin{bmatrix} \frac{2}{3} & \frac{-1}{3} \\ \frac{-1}{2} & \frac{1}{2} \end{bmatrix}$ C) $\begin{bmatrix} -4 & -3 \\ -2 & -3 \end{bmatrix}$ D) $\begin{bmatrix} 3 & 2 \\ 3 & 4 \end{bmatrix}$ E) NOTA

23) If we consider "row 0"of Pascal's Triangle to be 1 and "row 1" to be 1 1, what is the sum of the entries for "row 11"?

A) 2048   B) 1024   C) 512   D) 11   E) NOTA

24) Given the function $f(x) = \dfrac{x^2 - 1}{x^2 - 5x + 4}$. The removable discontinuity (hole) is located at the ordered pair (x_1, y_1) and the vertical asymptote has equation $x = a$. Find $x_1 + y_1 + a$.

 A) $4\dfrac{1}{3}$ B) 5 C) $5\dfrac{2}{5}$ D) $5\dfrac{2}{3}$ E) NOTA

25) In the diagram to the right, $\overline{PT}$ is tangent to circle C and $\overline{PN}$ intersects circle C at J. Find the radius of the circle.
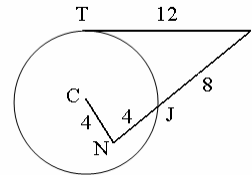
 A) 6 B) $2\sqrt{10}$ C) $4\sqrt{10}$ D) 48 E) NOTA

26) Simplify. $\dfrac{\dfrac{u+v}{u-v} - \dfrac{u-v}{u+v}}{\dfrac{u+v}{u-v} + \dfrac{u-v}{u+v}}$

 A) 0 B) –1 C) $\dfrac{2uv}{(u+v)^2}$ D) $\dfrac{u+v}{u-v}$ E) NOTA

27) Jerrod is hosting a party and wants to serve orange drink. Jerrod pulls out an orange drink from his refrigerator that contains 10% orange juice. He needs 6 quarts of the drink to serve at the party and wants the drink to contain 40% orange juice. How much 10% drink orange juice should Jerrod mix with pure orange juice to obtain 6 quarts of a mixture that contains 40% orange juice?

 A) 4 B) 3 C) 2 D) 0.2 E) NOTA

28) If r varies directly with p and inversely with the square of q and r = 27 when p = 3 and q = 2, find r if p = 2 and q = 3.

 A) 4 B) 8 C) 36 D) 91.125 E) NOTA

29) According to "The Hitchhiker's Guide to the Galaxy", what is the answer to the question? Oh, so some of you haven't read the book or seen the movie. Ok, then solve this simple problem, and you will know the answer: $7^2 - 7 = ?$

 A) 1 B) 7 C) 42 D) 49 E) NOTA

30) Find the value of h in the diagram shown:

 A) 5 B) 12 C) 13

 D) 41 E) NOTA