1) C
2) A
3) D
4) A
5) C
6) B
7) B
8) B
9) A
10) C
11) C
12) C
13) C
14) D
15) B
16) C
17) B
18) D
19) A
20) C
21) C
22) A
23) A
24) A
25) B
26) E
27) A
28) B
29) C
30) B

1) $(1 + i)^2 = 2i$ $(2i)^{10} = -1024$ **C**

2) Fermat's Last Theorem : There are no non-zero integer solutions to $x^n + y^n = z^n$ when $n > 2$. **A**

3) P(at least 2 were born on the same day) = 1 - P(all born on different days)= $1 - \left(1 \bullet \frac{6}{7} \bullet \frac{5}{7} \bullet \frac{4}{7}\right) = \frac{223}{343}$ **D**

4) $ax^2 + cx^2 + 10x^2 = 8x^2$
$ax + bx - 2x = -3x$
$a + b + 2c = -11$

$a + c + 10 = 8$
$a + b - 2 = -3$
$a + b + 2c = -11$

$a + c = -2$
$a + b = -1$
$a + b + 2c = -11$

→ a = 3, b = -4, c = -5
→ 4(3) + (-4) – (-5) = 13 **A**

5) $V_{cylinder} = \pi r^2 h = \pi(9)(10) = 90\pi$ $V_{cone} = \frac{1}{3}\pi r^2 h = \frac{1}{3}\pi(9)(5) = 15\pi$ $90\pi - 30\pi = 60\pi$ **C**

6) $25x^2 - 150x + 4y^2 + 32y + 189 = 0$ → $\left(\frac{x-3}{2}\right)^2 + \left(\frac{y+4}{5}\right)^2 = 1$ $A = r_x r_y \pi = (2)(5)\pi = 10\pi$ **B**

7) $(-1)^{2006} + 1 = 2$ **B**

8) $2^6 - 1 = 63$. Proper subsets do not include the set itself. **B**

9) $25x^2 + 9y^2 - 200x + 18y + 184 = 0$ → $\left(\frac{x-4}{3}\right)^2 + \left(\frac{y+1}{5}\right)^2 = 1$ center : (4, -1)

$9x^2 - 4y^2 + 90x + 32y + 197 = 0$ → $-\left(\frac{x+5}{2}\right)^2 + \left(\frac{y-4}{3}\right)^2 = 1$ center : (-5, 4)

$m = \frac{-1-4}{4-(-5)} = \frac{-5}{9}$; $y + 1 = \frac{-5}{9}(x-4)$ → $5x + 9y = 11$ **A**

10) $V_{block} = (30 \bullet 20 \bullet 20) - (2 \bullet 10 \bullet 10 \bullet 20) = 8000\text{ cm}^3$ Since $1\text{ m}^3 = 1{,}000{,}000\text{ cm}^3$, $8000\text{ cm}^3 = 0.008\text{ m}^3$
(0.008)(1700) = 13.6 kg. **C**

11)

	BC	**Bc**	**bC**	**bc**
BC	BBCC	BBCc	BbCC	BbBc
Bc	BBCc	BBcc	BbCc	Bbcc
bC	BbCc	BbCc	**bbCC**	**bbCc**
bc	BbCc	Bbcc	**bbCc**	bbcc

P(yellow feathers) = $\frac{3}{16}$ **C**

12) $342_7 = (3 \bullet 7^2) + (4 \bullet 7) + 2 = 177$

$$\begin{aligned}
177 \div 128 &= 1 \text{ (remainder 49)} \\
49 \div 64 &= 0 \text{ (remainder 49)} \\
49 \div 32 &= 1 \text{ (remainder 17)} \\
17 \div 16 &= 1 \text{ (remainder 1)} \\
1 \div 8 &= 0 \text{ (remainder 1)} \\
1 \div 4 &= 0 \text{ (remainder 1)} \\
1 \div 2 &= 0 \text{ (remainder 1)} \\
1 \div 1 &= 1 \text{ (remainder 0)}
\end{aligned}$$

→ 10110001 **C**

13) 69 + 50 + 55 – 26 – 15 – 27 + 11 + 33 = 150 **C**

14) $y = 3(x^2 + 8x) + 50 \quad = 3(x^2 + 8x + 16) + 50 - 48 \quad = 3(x + 4)^2 + 2$
vertex is at (-4, 2)
distance from vertex to focus is $\frac{1}{4(3)} = \frac{1}{12}$ parabola turns up, so focus is at $\left(-4, 2\frac{1}{12}\right)$ **D**

15) Won's journey forms a right triangle, 9 X 40. $9^2 + 40^2 = 1681$ → 41 **B**

16)

$$103\frac{3}{7} = 81\frac{2}{7} + (6 - 1)d$$

$$4\frac{3}{7} = d$$

$$a = 85\frac{5}{7},\ b = 90\frac{1}{7},\ c = 94\frac{4}{7},\ d = 99$$

sum is $369\frac{3}{7}$ **C**

17) ${}_7C_4\,(x^4)^3\left(\frac{1}{x^3}\right)^4 = \frac{7!}{4!3!} = 35$ **B**

18) X **D**

19)

$$\frac{10}{\sqrt[3]{2} - \sqrt[3]{7}} \bullet \frac{\sqrt[3]{4} + \sqrt[3]{14} + \sqrt[3]{49}}{\sqrt[3]{4} + \sqrt[3]{14} + \sqrt[3]{49}}$$

$$\frac{10\left(\sqrt[3]{4} + \sqrt[3]{14} + \sqrt[3]{49}\right)}{-5} = -2\sqrt[3]{4} - 2\sqrt[3]{14} - 2\sqrt[3]{49}$$ **A**

20) $p^2 - 2 = p \quad p^2 - p - 2 = 0 \quad (p - 2)(p + 1) = 0 \quad p = 2, -1$ ← extraneous **C**

21) $A = \frac{180(8-2)}{8} = 135$ $D = \frac{8(8-3)}{2} = 20 \rightarrow 135 + 20 = 155$ **C**

22) determinant[A] = 12 – 6 = 6

$$\frac{1}{6}\begin{bmatrix} 3 & 2 \\ 3 & 4 \end{bmatrix} =$$

$$\begin{bmatrix} \frac{1}{2} & \frac{1}{3} \\ \frac{1}{2} & \frac{2}{3} \end{bmatrix}$$ **A**

23) $2^{11} = 2048$ **A**

24) $f(x) = \frac{(x+1)(x-1)}{(x-4)(x-1)}$ hole: $\left(1, \frac{-2}{3}\right)$; asymptote : x = 4 $1 + \frac{-2}{3} + 4 = 4\frac{1}{3}$ **A**

25 Draw $\overline{CA}, \overline{ND}, \overline{NB}$; CA=r, ND=r-4, NB=x, PB=12+x, AN=r+4
$(PT)^2 = (PB)(PJ) \rightarrow 12^2 = (12+x)(8) \rightarrow x = 6 = NB$ (NJ)(NB) = (AN)(ND) → (4)(6) = (r+4)(r-4)
$\rightarrow r = \sqrt{40} = 2\sqrt{10}$ **B**

26)

$$\frac{\frac{u+v}{u-v} - \frac{u-v}{u+v}}{\frac{u+v}{u-v} + \frac{u-v}{u+v}} \bullet \frac{(u-v)(u+v)}{(u-v)(u+v)} =$$

$$\frac{u^2 + 2uv + v^2 - (u^2 - 2uv + v^2)}{u^2 + 2uv + v^2 + (u^2 - 2uv + v^2)} =$$

$$\frac{4uv}{2(u^2 + v^2)} = \frac{2uv}{u^2 + v^2}$$ **E**

27) (0.10)(x) + (1)(6-x) = (.40)(6) 0.1x + 6 – x = 2.4 x = 4 **A**

28)

$$r = \frac{kp}{q^2} -> 27 = \frac{k(3)}{4} -> 36 = k$$

$$r = \frac{(36)(2)}{9} = 8$$ **B**

29) 42 **C**

30) Let QR=x and PQ=21-x $h^2 + x^2 = 169$ $h^2 + (21-x)^2 = 400$ $h^2 + 441 - 42x + x^2 = 400$
$169 + 441 - 42x = 400$ $x = 5 \rightarrow h=12$ **B**