

1. $\frac{1}{2} + \frac{\sqrt{2}}{2} - \sqrt{3} + 2$
 $\frac{3 + \sqrt{2} + 2\sqrt{3}}{2}$ C

5. $|4 - 4i| = 4\sqrt{2}$ A-D satisfy
 $\angle(4 - 4i) = -\frac{\pi}{4} + 2\pi n$
 B fails B

2. $12288 \cdot \left(\frac{1}{4}\right)^9 = \frac{2^{12} \cdot 3}{2^{18}} = \frac{3}{2^6} = \frac{3}{64}$ B

6. $\sqrt{16 + 324 + 144} = \sqrt{484} = 22$ C

3. $\left(1 - \frac{5}{6}\right) \cdot \frac{9}{10} = \frac{1}{6} \cdot \frac{9^3}{10} = \frac{3}{20}$ A

7. $\frac{\frac{1}{\cos^2 \theta}}{\frac{1}{\cos \theta}} = \frac{1}{\cos \theta} = \sec \theta$ B

4. $\frac{\ln\left(\frac{1}{625}\right)}{\ln 125} = \frac{-4 \ln 5}{3 \ln 5} = -\frac{4}{3}$ B

8. I. parabola, not always = 0 X

II. $\frac{1}{\sin^2 \theta} - \frac{\cos^2 \theta}{\sin^2 \theta} = \frac{\sin^2 \theta}{\sin^2 \theta}$ ✓

III. $\sin^2 \theta - \cos^2 \theta = 1 - 2\cos^2 \theta$ X B

10. The 17th term is the middle of the first 33, and this equals the average value.

$\frac{121}{33} = \frac{11}{3}$ C

9. 3, 8, 9, 9, 10, 11, 14, 15, 20
 mode = 9 median = 10
 mean = $\frac{99}{9} = 11$ B

11. $3 \cdot 1 + 5 \cdot 2 + 7 \cdot 3 + 9 \cdot 4 + 11 \cdot 5$
 $+ 13 \cdot 6 + 15 \cdot 7 + 17 \cdot 8 + 19 \cdot 9 + 1 \cdot 10$
 $= 3 + 10 + 21 + 36 + 55 + 78 + 105 + 136 + 171 + 10$
 $= 625$ B

12. $\left(\frac{4}{5}\right)^5 + \binom{5}{4} \left(\frac{4}{5}\right)^4 \cdot \left(\frac{1}{5}\right)^1$
 $= \frac{9 \cdot 4^4}{5^5} = \frac{2304}{3125}$ B

13. 13 ways to choose XXX denomination
 $\binom{12}{2}$ ways to choose singleton "s"
 4 ways to choose which X to exclude
 4 \cdot 4 ways to choose which Y & Z to use

$\implies 54912$ "good" outcomes
 $52 \cdot 5$ total outcomes
 $P = \frac{88}{4165}$ D

14. 7! & everything higher $\equiv 0 \pmod{28}$
 so don't worry about them.

$$2! + 4! + 6! = 2 + 24 + 720 = 746$$

$$746 \equiv 18 \pmod{28} \quad C$$

$$15. \frac{b(4-2i)}{20} + \frac{2b(3+i)}{10} = 5$$

$$b(4-2i) + 2b(3+i) = 100$$

$$10b = 100$$

$$b = 10 \quad C$$

$$16. 1422 = 2^1 \cdot 3^2 \cdot 79^1$$

$$\# \text{ factors} = (1+1)(2+1)(1+1) = 12$$

"bad" factors: 1, 2, 3, 6, 9, 18

$$12 - 6 = 6 \quad D$$

$$17. \begin{bmatrix} 3 \cdot 4 + 1 \cdot 1 & 3 \cdot 2 + 1 \cdot 2 \\ -2 \cdot 4 + 3 \cdot 1 & -2 \cdot 2 + 3 \cdot 2 \end{bmatrix}$$

$$\begin{bmatrix} 13 & -4 \\ -11 & -2 \end{bmatrix} \quad A$$

$$18. A \cdot B = 2 \cdot 1 + 3 \cdot 5 = \sqrt{2^2 + 3^2} \sqrt{1^2 + 5^2} \cos \theta$$

$$\cos \theta = \frac{13}{\sqrt{13} \sqrt{26}} = \frac{1}{\sqrt{2}} = \frac{\sqrt{2}}{2}$$

$$\sin \theta = \frac{\sqrt{2}}{2} \quad B$$

$$19. \begin{matrix} 14R & 14R \\ 6B & 25B \end{matrix}$$

$$\begin{matrix} \frac{7}{10}R & \frac{15}{40}R \\ \frac{3}{10}B & \frac{14}{40}R \end{matrix} = \frac{105}{400} = \frac{147}{400} \quad C$$

$$20. A = \frac{1}{2}bh = \frac{1}{2}ab \sin \theta = \frac{1}{2}|\vec{A} \times \vec{B}|$$

area base side length side vectors

$$\vec{A} = [1, 2, 3] \quad \vec{A} \times \vec{B} = 0\vec{i} + 3\vec{j} + 2\vec{k}$$

$$\vec{B} = [-2, -2, -3]$$

$$\frac{1}{2}|\vec{A} \times \vec{B}| = \frac{\sqrt{9+4}}{2} = \frac{\sqrt{13}}{2} \quad D$$

$$21. \frac{x^A 5^6}{x^9 5^{-12}} = 5^{18} \quad C$$

$$22. \tan A = \frac{7}{-24} \quad A$$

$$23. \log_{144} (x+1)^2 + \log_{144} (x-1) = 1$$

$$\log_{144} ((x+1)^2(x-1)) = 1$$

$$(x+1)^2(x-1) = 144$$

$$(x^2-1)(x+1) = 144$$

$$x^3 + x^2 - x - 145 = 0$$


$$(x-5)(x^2 + 6x + 29) = 0 \quad C$$

24. $17-18 \rightarrow 66 \cdot 18$

$$18 \sum_{n=17}^{66} n = 18 [33 \cdot 67 - 8 \cdot 17]$$

$$= 37350 \quad E$$

25. $y = 5^x \quad y^2 - 4y - 5 = 0$
 $(y-5)(y+1) = 0$
 $y = 5, y = -1$
 $x = 1, \emptyset \quad A$

28.  $h = \sqrt{196 - 36}$
 $= \sqrt{160}$
 $= 4\sqrt{10}$
 $V = \frac{1}{3} \pi r^2 h = \frac{\pi \cdot 36 \cdot 4\sqrt{10}}{3}$
 $= 48\pi\sqrt{10} \quad A$

29. $m_1 = \frac{5}{2} \Rightarrow m_{\perp} = -\frac{2}{5}$
 $y = -\frac{2}{5}x + b$
 $-3 = -\frac{2}{5}(15) + b \Rightarrow b = -1 \quad B$

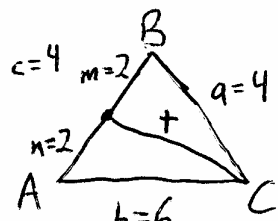
32. $\frac{45}{5} = 9$
 $\frac{9}{5} = 1$
 10 C

BB,

26. $1+3i, 1-3i, 4$

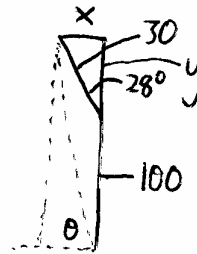
$$(x^2 - 2x + 10)(x - 4)$$


$$10x + 8x = 18x \quad B$$

27.  $a^2 + b^2 - m^2 = t^2 + m^2 + n^2$
 $32 + 72 = 4 + t^2 + 16$
 $22 = t^2 \quad D$

30. $\triangle ADC$ similar to $\triangle BDA$
 $AD = \sqrt{36 - 16} = \sqrt{20} = 2\sqrt{5}$
 $\frac{DC}{AD} = \frac{AD}{BD} \Rightarrow DC = \frac{20}{4} = 5 \quad D$

31. $x = 30 \sin 28 \approx 14.08$
 $y = 30 \cos 28 \approx 26.49$
 $\theta = \tan^{-1} \left(\frac{126.49}{14.08} \right)$
 $\approx 83.965 \quad A$



33.  $A = \frac{2}{3} \pi 6^2 + \frac{1}{2} 3 \cdot 6\sqrt{3}$
 $= 24\pi + 9\sqrt{3} \quad E$

34. As x goes from $3n$ to $3n+3$,
 y goes from 0 to 1, then
 repeats, so $T=3$ C

35. ~~WFAWZ~~
 $r_1 \cdot 3r_1 = \frac{36}{3} = 12$
 $r_1^2 = 4$
 $r_1 = \pm 2 \Rightarrow r_2 = \pm 6$
 $\pm 6 \pm 2 = \pm 8 = -\frac{c}{3} \Rightarrow c = \pm 24$ D

38. $A^{-1} = \frac{1}{|A|} A^{\text{adj}}$
 $= \frac{1}{6} \begin{bmatrix} 1 & 2 \\ -2 & 2 \end{bmatrix}$ A

39. $4 \cdot 25 + 2 \cdot 5 + 3 = 113$
 $= 2 \cdot 49 + 2 \cdot 7 + 1 = 221_7$ C

36. $f(6) = 144 - 18 - 8 = 118$
 $g(118) = 15 - 354 = -339$ B

37. $z(z-1) = z^3 - 3$
 $0 = z^3 - z^2 + z - 3$
 sum of roots = $-\frac{-1}{1} = 1$ D

40. $1 - \cos^2 \theta + \frac{3}{2} \cos \theta = \frac{3}{2}$
 $\cos^2 \theta - \frac{3}{2} \cos \theta + \frac{1}{2} = 0$
 $y = \cos \theta$
 $y^2 - \frac{3}{2}y + \frac{1}{2} = 0$
 $(y - 1)(y - \frac{1}{2}) = 0$
 ~~$\cos \theta = 1$~~
 ~~$\cos \theta = \frac{1}{2}$~~
 $\cos \theta = \frac{1}{2}$
 $\theta = 0$ $\theta = \frac{\pi}{3}, \frac{5\pi}{3}$
 $\Sigma = 2\pi$ A