

**Alpha Applications Solutions**  
**FAMAT State Convention 2003**

1.  $1 \cdot \frac{3}{51} \cdot \frac{2}{50} = \frac{1}{425}$  **B**

2.  $s = r\theta = \frac{10}{2} \cdot \left(67 \cdot \frac{\pi}{180}\right) \approx 5.85$  **A**

3.  $103_4 = 19_{10} = 10011_2$  **D**

4.  $\cos(\phi) = \sin(\phi) \cdot \cot(\phi) = -\frac{6}{\sqrt{38}}$  **E**

5. Law of sines:

$$\frac{\sin(35)}{13} = \frac{\sin(\angle ADB)}{5} \Rightarrow \angle ADB \approx 12.75^\circ$$

$$\Rightarrow \angle ABD \approx 132.26^\circ$$

$$\text{Area} = 2 \left( \frac{1}{2} \cdot 5 \cdot 13 \sin(132.26) \right) \approx 48.11$$
 **D**

6. Converse of  $p \rightarrow q$  is  $q \rightarrow p$  **C**

7.  $P_2 - P_1 = (-7, 3, 0)$

$P_3 - P_1 = (10, -1, 3)$

$$\frac{1}{2} |(-7, 3, 0) \times (10, -1, 3)| \approx 16.21$$
 **C**

8. Geometric series:

$$\frac{\cos(\beta)}{1 - \cos(\beta)} = \frac{3}{2}$$

$$\cos(\beta) = \frac{3}{2} \Rightarrow \sin(\beta) = \frac{4}{5}$$

$$\frac{.8}{1 - .8} = 4$$
 **B**

9.  $X = \sqrt{9 - X}$

$$X \approx 2.54$$
 **A**

10. II, III, IV are true. So 3 are true. **E**

11.  $x =$  number of times inner loop is run

$$x = \sum_{j=1}^n \sum_{k=1}^j 1 = \sum_{j=1}^n j = \frac{n(n+1)}{2}$$
 **C**

12.  $2 \cdot 5 \cdot \begin{vmatrix} 3 & -4 \\ 5 & -6 \end{vmatrix} + 12 \cdot 2 \cdot -1 = -4$  **A**

13. Solve simultaneously:

$$-a + b - c + d = 5$$

$$d = 4$$

$$a + b + c + d = 3$$

$$8a + 4b + 2c + d = 8$$

$$p(x) = x^3 - 2x + 4$$

$$p(3) = 25$$
 **B**

14.  $\left\lfloor \frac{15328}{17} \right\rfloor = 901$

$$\frac{901}{15328}$$
 **B**

15.  $.25x + .1y = 4.6$

$$x + y = 28$$

$$x = 16$$
 **D**

16.  $[0, \pi)$  **E**

17.  $\tan(b) = \frac{20}{r}$

$$\tan(2b) = \frac{2 \tan(b)}{1 - \tan^2(b)} = \frac{46}{r}$$

$$r \approx 55.4$$
 **C**

18.  $(15 \text{ nCr } 4)(11 \text{ nCr } 5)(6 \text{ nCr } 3)(3 \text{ nCr } 3)$

$$= \frac{15!}{4!5!3!3!} = 12612600$$
 **A**

19. Starting with man:

$$(20 \text{ nPr } 20)(20 \text{ nPr } 20) = (20!)^2$$

Starting with woman:

$$(20 \text{ nPr } 20)(20 \text{ nPr } 20) = (20!)^2$$

$$\text{So total} = 2(20!)^2$$
 **E**

20.  $\log n$  increases slowest of all **C**

21. **B** gives the correct sequence

22.  $(2t - 5)^2 + (t + 1)^2 = 4$  has no real solutions for  $t$   
So the boat will never intersect the island **D**

23.  $\frac{a}{d} = 3 \Rightarrow \frac{d^2}{a^2} = \frac{1}{9}$  **E**

24.  $A = \frac{1}{2} ab \cdot \sin \theta = \frac{1}{2} (6)(6) \sin 65 \approx 16.3$  **D**

25.  $\left| \frac{i}{i-1} + (i-1)^2 \right| = \left| \frac{1}{2} - \frac{5}{2}i \right| = \sqrt{\frac{13}{2}}$  **A**

26.  $g(x) = x! \dots g(7) = 7! = 5040$  **B**

27.  $2x + 5 = 17$  and  $5^2 = x^2 + x^2 - 2x^2 \cos(\theta)$   
 $\theta \approx 49.25$  **A**

28.  $\begin{vmatrix} 5 & 6 \\ 2 & 4 \end{vmatrix} = 8$  **C**

29. Probability that both are by the same band:

$$\frac{5}{10} \cdot \frac{4}{9} (2 \text{ Pumpkins}) + \frac{4}{10} \cdot \frac{6}{9} (2 \text{ Pearl Jam}) = \frac{16}{45}$$

$$1 - \frac{16}{45} = \frac{29}{45}$$
 **C**

30. Simplify to  $\log(d^2) = \log(50)$

$$d \approx 7.07$$
 **A**