

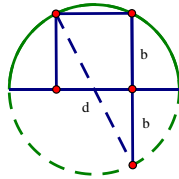
**SML Round 1 2011-2012**  
**Short Answers**

1. **E**  $2 \cdot 3^2 + 3 = 6^5 = 7776$
2. **B** Let  $s$  be the amount of the stock. Monday  $1.2s$ , Tuesday  $1.2s - .1(1.2s) = 1.08s$ ,  
Wednesday  $1.08s + \frac{1}{6}(1.08s) = 1.26s$ , a rise of 26%
3. **D**  $2a - 3b = 8$  and  $2a + 3b = 20 \Rightarrow$  the solution to this system is  $a = 7, b = 2$ . So  $a + b = 9$
4. **D** By trial and error,  $3^6 + 21^2 + 29^2 = 2011$ . So  $a + b + c = 3 + 21 + 29 = 53$
5. **C** 0 red and any amount of white gives 1 mix; 1 red and 0,1,2,3,4, or 5 white gives 6 more; 2 red and 1,3, or 5 white gives 3 more; 3 red and 1,2,4, or 5 white gives 4 more; and 4 red and 1,3, or 5 white gives 3 more. So there are  $1+6+3+4+3 = 17$  shades.
6. **A**  $2 - 2x$  must equal  $-2$  or  $6$ . So  $x = 2, -2$
7. **B** When  $t = 3, P_1 = Pe^{3t}$  and  $P_2 = Pe^{-3t}$ .  $P_1 \cdot P_2 = P^2$
8. **C**  $(x+8)(x+1) \Rightarrow b = 9$ .  $(x+4)(x+2) \Rightarrow c = 6$ . So  $b - c = 3$
9. **B** Let  $x =$  distance traveled in 30 minutes.

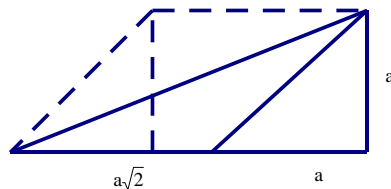
$$x + (x - 2.5) + (x - 5) + (x - 7.5) + (x - 10) + (x - 12.5) + \frac{2}{3}(x - 15) = 197.5 \Rightarrow x = 36.75$$

In 2 hours,  $4x - 15 = 4(36.75 - 15) = 132$  miles.

10. **D** Amount of antifreeze:  $2 - .2x + x = 2.5 \Rightarrow x = 0.625$
11. **E**  $P(7,1) + P(7,2) + P(7,3) + P(7,4) + P(7,5) + P(7,6) = 8659$
12. **D** The given lines intersect at the point  $(-6,12)$ . Construct a line through the origin that is parallel to each:  $y = -\frac{2}{3}x$  and  $y = -\frac{3}{2}x$ . The first one goes through  $(3,-2)$  and the other goes through  $(-2,3)$ . These two lines are symmetric with respect to the line  $y = x$ . The given lines are then symmetric with respect to the line that goes through  $(-6,12)$  and is parallel to the line  $y = x$ . That line has equation  $y - 12 = x + 6$  or  $y = x + 18$  so  $m + b = 19$ .
13. **B** If  $a$  is the length of a side of the square inscribed in  $C$ , then  $a$  is the diameter of the circle  $C$ . Let  $b$  be the length of a side of a square inscribed in a semicircle of  $C$ . Then  $b^2 + (2b)^2 = d^2 = 90 \Rightarrow b^2 = 18$



$$14. \text{ C } a + a\sqrt{2} = 157 \Rightarrow a = \frac{157}{1 + \sqrt{2}} \approx 65$$



15. **A** Total # of boxes =  $6 + 5n$ . # empty =  $5 - n + 5n = 5 + 4n$ .  
 # full =  $(6 + 5n) - (5 + 4n) = 1 + n$ .  $1 + n = 18 \Rightarrow$  #empty =  $5 + 4 \cdot 17 = 73$

16. **D** Al – chemistry, Bo – physics, Cy – biology, Di – math

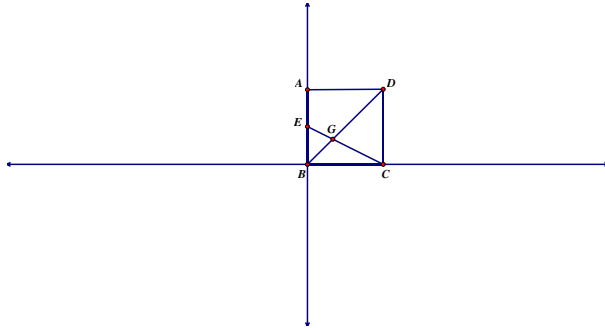
17. **C**  $\sqrt[3]{9!} \approx 71.3$  So the smallest possible value of  $P$  is 72.

18. **D**

# red in box	10	9	8	7	6	5	4	3	2	1	0
# red in bag	0	0-1	0-2	0-3	0-4	0-5	0-6	0-6	0-6	0-6	1-6
# ways	1	2	3	4	5	6	7	7	7	7	6

Total # ways =  $1 + 2 + 3 + 4 + 5 + 6 + 7 + 7 + 7 + 7 + 6 = 55$

19. **D**



$\overline{BD}$  lies along the line  $y = x$  and  $\overline{EC}$  lies along the line  $y = -\frac{1}{2}x + 36$ . Set these equal and solve for  $x$ .  $x = 24$

20. **E**

$$9x^5 + 7x^2 - 9 = 0 \Rightarrow x^5 - 1 = -\frac{7}{9}x^2$$

$$y = r^4 + 2r^9 + \dots + kr^{5k-1} + \dots = (x^4 + x^9 + x^{14} + \dots) + (x^9 + 2x^{14} + 3x^{19} + \dots) =$$

$$\frac{x^4}{1-x^5} + x^5(x^4 + 2x^9 + 3x^{14} + \dots) = \frac{x^4}{1-x^5} + x^5 \cdot y$$

$$\text{So, } y = \frac{x^4}{1-x^5} + x^5 \cdot y$$

$$\text{Thus, } y = \frac{x^4}{(1-x^5)^2} = \frac{x^4}{\left(\frac{7}{9}x^2\right)^2} = \frac{81}{49}$$

$$81 + 49 = 130$$