

2004 SENIOR PRETEST

1. How many natural number divisors exist for $3^4 \cdot 7 \cdot 11^2$?
 (a) 8 (b) 10 (c) 30 (d) 32 (e) none of these

2. For all positive numbers x and y , the operation $*$ is defined to be $x * y = y^x$. Which of the following choices are always true for all positive numbers x , y and z ?
 (i) $1 * y = y$ (ii) $x * x = x^2$ (iii) $x * y = y * x$
 (iv) $(x * y) * z = x * (y * z)$ (v) $(x + y) * z = x * z + y * z$
 (a) all are true (b) none are true (c) only (i) is true
 (d) only (i) and (iv) are true (e) only (i), (iv) and (v) are true

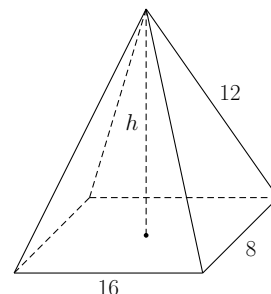
3. The first three terms of an arithmetic sequence, in order, are $2x + 4$, $5x - 4$ and $3x + 4$. What is the sum of the first 10 terms of this sequence?
 (a) 176 (b) 202.4 (c) 352 (d) 396 (e) none of these

4. The line $y = \frac{1}{2}x + B$ is tangent to the graph of $y = -\frac{1}{4}(x^2 - 16x + 49)$. What is the value of B ?
 (a) $-\frac{1}{3}$ (b) 0 (c) $\frac{1}{3}$ (d) $\frac{3}{4}$ (e) $\frac{4}{3}$

5. If three fair dice are rolled, what is the probability that none will show six and all will show different numbers?
 (a) $\frac{5}{18}$ (b) $\frac{125}{216}$ (c) $\frac{5}{9}$ (d) $\frac{1}{8}$ (e) none of these

6. The pyramid at the right has an 8 by 16 rectangular base; its other four edges are equal to 12. Which of the following is closest in value to the height h ?

- (a) 7.5 (b) 8 (c) 8.5 (d) 9 (e) 9.5



7. Alan, Bob, Carl and Dick all had stock in Enron, although no two had the same amount, and all lost everything when Enron went belly up. Dick lost less than Bob, and together Dick and Bob lost the same amount as the total lost by Alan and Carl. Together Carl and Dick lost less than Alan. Alan did not lose the most. Order the four from who lost the most to who lost the least.

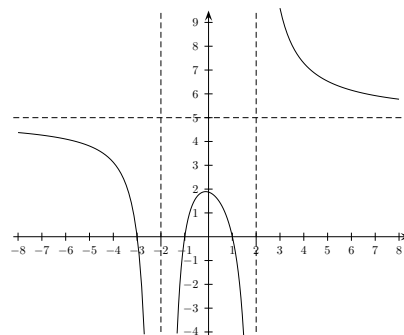
- (a) Alan > Bob > Dick > Carl
 (b) Bob > Carl > Alan > Dick
 (c) Bob > Carl > Dick > Alan
 (d) Carl > Bob > Alan > Dick
 (e) Bob > Alan > Carl > Dick

8. Using only the letters from the word WILDCATS with no repetitions allowed in a codeword, how many 4 letter codewords are possible that both start and end with a consonant?

- (a) 2,204 (b) 1,680 (c) 900 (d) 360 (e) none of these

9. Which of the following functions does the graph of the rational function on the right correspond to?

- (a) $\frac{5(x^2 - 1)(x + 3)}{(x^2 - 4)(x + 2)}$ (b) $\frac{(x^2 - 1)(x + 3)}{(x^2 - 4)(x + 2)}$
 (c) $\frac{5(x^2 - 1)(x + 3)}{(x^2 - 4)}$ (d) $\frac{(x^2 - 1)}{(x^2 - 4)}$ (e) $\frac{5(x^2 - 4)(x + 2)}{(x^2 - 1)(x + 3)}$

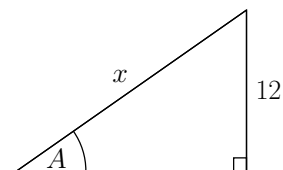


10. Drain pipe number one is observed to drain a pool that is $\frac{2}{5}$ full in 3 hours. Number two is observed to drain that same pool when it is $\frac{1}{4}$ full in 1.25 hours. How long would it take the two of them, working together, to drain a pool that is $\frac{2}{3}$ full?

- (a) 1.25 hrs (b) 1.75 hrs (c) 2.25 hrs (d) 2.75 hrs (e) none of these

11. Solve for x in the triangle at the right given that $\tan(A) = \frac{1}{2}$.

- (a) $6\sqrt{5}$ (b) $12\sqrt{5}$ (c) 18 (d) 24 (e) none of these



12. The figure on the right shows the derivative of function f . Which of the following are true?

(i) f is decreasing in $(-1, 1)$.

(ii) f has a local minimum at 2.

(iii) f is an odd function.

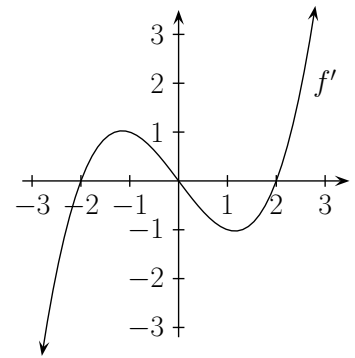
(a) none are true

(b) only (iii) is true

(c) only (i) and (iii) are true

(d) only (ii) is true

(e) all of them are true



13. The sum of the solutions to the equation $\frac{4}{2x+1} - \frac{x}{x+2} = 1$ is:

(a) $-\frac{1}{2}$

(b) $\frac{1}{2}$

(c) $-\frac{5}{2}$

(d) $\frac{5}{2}$

(e) none of these

14. In the figure on the right, lines a and b are parallel. What is the measure of angle α ?

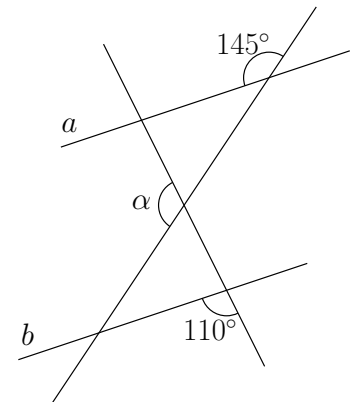
(a) 95°

(b) 105°

(c) 110°

(d) 145°

(e) none of these



15. Assuming that all men work at the same rate, if x men can mine y tons of coal in z days, how many tons can b men mine in c days?

(a) $\frac{bc}{xz}$

(b) $\frac{bc}{xyz}$

(c) $\frac{bcx}{yz}$

(d) $\frac{bcy}{xz}$

(e) none of these