



## SECTION 9

Time — 20 minutes

16 Questions

Turn to Section 9 (page 7) of your answer sheet to answer the questions in this section.

**Directions:** For this section, solve each problem and decide which is the best of the choices given. Fill in the corresponding circle on the answer sheet. You may use any available space for scratchwork.

Notes

- The use of a calculator is permitted.
- All numbers used are real numbers.
- Figures that accompany problems in this test are intended to provide information useful in solving the problems. They are drawn as accurately as possible EXCEPT when it is stated in a specific problem that the figure is not drawn to scale. All figures lie in a plane unless otherwise indicated.
- Unless otherwise specified, the domain of any function  $f$  is assumed to be the set of all real numbers  $x$  for which  $f(x)$  is a real number.

Reference Information

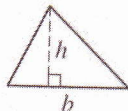


$$A = \pi r^2$$

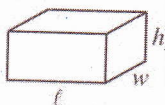
$$C = 2\pi r$$



$$A = \ell w$$



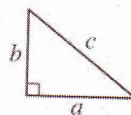
$$A = \frac{1}{2}bh$$



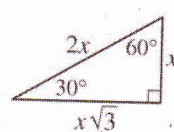
$$V = \ell wh$$



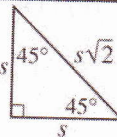
$$V = \pi r^2 h$$



$$c^2 = a^2 + b^2$$



Special Right Triangles



The number of degrees of arc in a circle is 360.

The sum of the measures in degrees of the angles of a triangle is 180.

1. For which of the following values of  $m$  will the value of  $3m - 1$  be greater than 10?

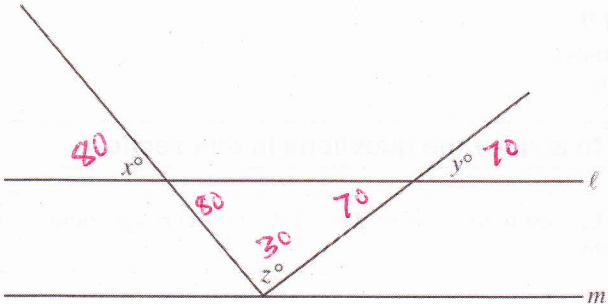
- (A) 4  $\cdot 3 = 12 - 1 = 11$   
 (B) 3  
 (C) 2  
 (D) 1  
 (E) 0

2. If  $a \times k = a$  for all values of  $a$ , what is the value of  $k$ ?

- (A)  $-a$   
 (B)  $-1$   
 (C) 0  
 (D) 1  
 (E)  $a$

If you don't see an immediate solution (i.e. any number  $\cdot 1 =$  the same number), pick a number for  $a$ .  
 If  $a = 3$  and  $3k = 3$ ,  
 $k = 1$

GO ON TO THE NEXT PAGE



Note: Figure not drawn to scale.

3. In the figure above,  $l \parallel m$ . If  $x = 80$  and  $y = 70$ , what is the value of  $z$ ?

- (A) 30  
(B) 60  
(C) 75  
(D) 90  
(E) 150

Fill in what  
you know.

4. The scenic route from Mia's home to her office is 5 kilometers longer than the direct route. When she goes by the scenic route and returns by the direct route, the round trip is 35 kilometers. How many kilometers is the direct route?

- (A) 5  
(B)  $12\frac{1}{2}$   
(C) 15  
(D) 20  
(E)  $22\frac{1}{2}$

$$15 + 5 = 20 + 15 = 35$$

5. A complete cycle of a traffic light takes 80 seconds. During each cycle, the light is green for 40 seconds, amber for 10 seconds, and red for 30 seconds. At a randomly chosen time, what is the probability that the light will not be red?

- (A)  $\frac{7}{8}$   
(B)  $\frac{5}{8}$   
(C)  $\frac{1}{2}$   
(D)  $\frac{3}{8}$   
(E)  $\frac{1}{8}$

Green 40  
Amber 10  
Red 30

$$R = \frac{30}{80}$$

$$\text{Not} = \frac{50}{80}$$

6. For a certain hot-water heater, the increase in heating expenses is directly proportional to the increase in water-temperature setting. If heating expenses increase by \$24 when the water-temperature setting is increased by 20 degrees Fahrenheit, by how much will heating expenses increase when the water-temperature setting is increased by 15 degrees Fahrenheit?

- (A) \$16  
(B) \$18  
(C) \$19  
(D) \$20  
(E) \$21

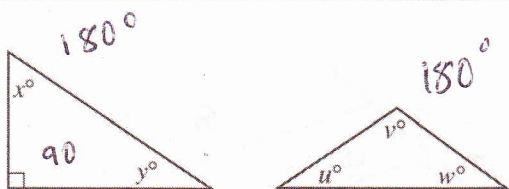
$$\frac{20}{24} = \frac{15}{x}$$

$$20x = 360$$

$$x = 18$$

Whenever  
you're given  
two numbers w/ a known relationship,  
and a third number, it's a ratio  
problem.

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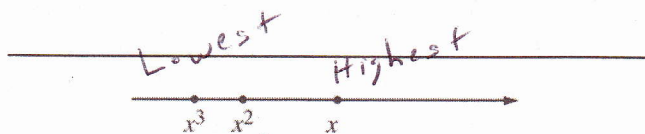
7. In the triangles above, what is the average (arithmetic mean) of  $u$ ,  $v$ ,  $w$ ,  $x$ , and  $y$ ?

- (A) 21  
(B) 45  
(C) 50  
(D) 52  
(E) 54

$$360 - 90 = 270$$

$$u + v + w + x + y = 270$$

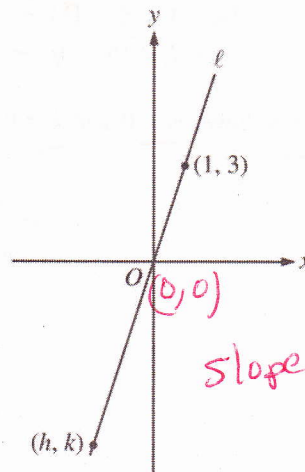
$$270 \div 5 = 54$$



8. If  $x$ ,  $x^2$ , and  $x^3$  lie on a number line in the order shown above, which of the following could be the value of  $x$ ?

- (A) ~~-2~~  
(B)  ~~$-\frac{1}{2}$~~   
(C)  $\frac{3}{4}$   
(D) ~~1~~  
(E)  ~~$\frac{3}{2}$~~

Backsolve



9. In the figure above, line  $\ell$  passes through the origin.

What is the value of  $\frac{k}{h}$ ?

- (A) 3  
(B) 2  
(C)  $\frac{3}{2}$   
(D)  $-\frac{3}{2}$   
(E) -3

$$\frac{0 - k}{0 - h} = 3$$

$$0 - k = -3h$$

$$-k = -3h$$

$$-\frac{k}{h} = -3$$

Always change the origin to  $(0,0)$  so you see the opportunity to calculate slope.

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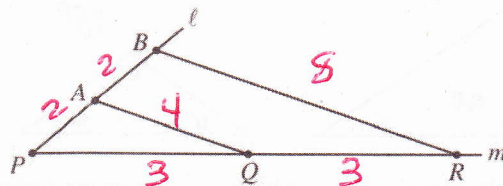
$$|m - 3| = 5 \quad m = -2$$

$$|k + 7| = 15 \quad k = -22$$

10. In the equations above,  $m < 0$  and  $k < 0$ . What is the value of  $m - k$ ?

- (A) -24  
(B) -14  
(C) 8  
(D) 16  
(E) 20

$$-2 - (-22) = 20$$



Note: Figure not drawn to scale.

12. In the figure above, points  $P$ ,  $A$ , and  $B$  are equally spaced on line  $\ell$  and points  $P$ ,  $Q$ , and  $R$  are equally spaced on line  $m$ . If  $PB = 4$ ,  $PR = 6$ , and  $AQ = 4$ , what is the perimeter of quadrilateral  $QABR$ ?

- (A) 13  
(B) 14  
(C) 15  
(D) 16  
(E) 17

Similar  
Triangles

#### RATINGS OF CAR ENGINE OIL

Rating	Relative Speed of Flow
10W	Half as fast as 5W oil
15W	Half as fast as 10W oil
20W	Half as fast as 15W oil

11. According to the table above, car engine oil with a rating of 5W flows how many times as fast as car engine oil with a rating of 20W?

- (A) 2  
(B) 4  
(C) 8  
(D) 16  
(E) 32

variables  $\rightarrow$  pick & plug

5W vs 20W

Assume 5W = 6

10W = 3

15W = 1.5

20W = .75

$$6 \div \frac{3}{4} = 8$$

$$24 \div 3 = 8$$

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Questions 13-14 refer to the following functions  $g$  and  $h$ .

$$g(n) = n^2 + n$$

$$h(n) = n^2 - n$$

13.  $g(5) - h(4) =$

- (A) 0  
(B) 8  
(C) 10  
(D) 18  
(E) 32

$$g(5) = 5^2 + 5 = 30$$

$$h(4) = 4^2 - 4 = 12$$

$$\underline{\quad\quad\quad}$$

$$18$$

14. Which of the following is equivalent to  $h(m+1)$ ?

- (A)  $g(m)$   
(B)  $g(m) + 1$   
(C)  $g(m) - 1$   
(D)  $h(m) + 1$   
(E)  $h(m) - 1$

$$h(m+1) = (m+1)^2 - (m+1)$$

$$= m^2 + 2m + 1 - m - 1$$

$$= m^2 + m = g(m)$$

per  
function at  
top of  
page

**STOP**

If you finish before time is called, you may check your work on this section only.  
Do not turn to any other section in the test.

This is  
because  $CDE +$   
 $ABED =$  the  
whole  
rectangle

$\frac{1}{4}$  of the whole rectangle and  $ABED =$   
 $\frac{3}{4}$  of the whole rectangle

$$ABED = \frac{2}{3} \text{ so}$$

$$\frac{3}{4}(\text{whole area}) = \frac{2}{3} \cdot \frac{4}{3} = \frac{8}{9}$$

15. A store charges \$28 for a certain type of sweater. This price is 40 percent more than the amount it costs the store to buy one of these sweaters. At an end-of-season sale, store employees can purchase any remaining sweaters at 30 percent off the store's cost. How much would it cost an employee to purchase a sweater of this type at this sale?

- (A) \$8.40  
(B) \$14.00  
(C) \$19.60  
(D) \$20.00  
(E) \$25.20

$$\$28 \text{ retail}$$

$$1.4 \cdot \text{Cost} = 28$$

$$\text{Cost} = \frac{28}{1.4} = \$20$$

$$- 30\% =$$

$$\$20 - 6 = 14$$

16. In rectangle  $ABCD$ , point  $E$  is the midpoint of  $\overline{BC}$ .

If the area of quadrilateral  $ABED$  is  $\frac{2}{3}$ , what is the area of rectangle  $ABCD$ ?

- (A)  $\frac{1}{2}$   
(B)  $\frac{3}{4}$   
(C)  $\frac{8}{9}$   
(D) 1  
(E)  $\frac{8}{3}$



Perpendicular line cuts  
rectangle into 2  
rectangles, each of  
which is  $\frac{1}{2}$  the original.

Triangle  $CDE$  is  $\frac{1}{2}$  smaller  
rectangle which is  $\frac{1}{2}$  of the  
whole rectangle.  $\therefore CDE =$