

FORMULAS FOR REFERENCE

| | | |
|----------|------------------------|--|
| SPHERE | Surface area | $= 4\pi r^2$ |
| | Volume | $= \frac{4}{3}\pi r^3$ |
| CYLINDER | Area of curved surface | $= 2\pi rh$ |
| | Volume | $= \pi r^2 h$ |
| CONE | Area of curved surface | $= \pi r l$ |
| | Volume | $= \frac{1}{3}\pi r^2 h$ |
| PRISM | Volume | $= \text{base area} \times \text{height}$ |
| PYRAMID | Volume | $= \frac{1}{3} \times \text{base area} \times \text{height}$ |

There are 54 questions in this paper.
The diagrams in this paper are not necessarily drawn to scale.

1. Express π^2 as a decimal correct to 3 significant figures.

- A. 9.86
- B. 9.87
- C. 9.88
- D. 9.860
- E. 9.870

2. If $2^x \cdot 8^x = 64$, then $x =$

- A. $\frac{3}{2}$
- B. $\frac{3}{4}$
- C. $\frac{6}{5}$
- D. 2
- E. 4

3. If $\frac{a+x}{b+x} = \frac{c}{d}$ ($c \neq d$), then $x =$

A. $\frac{c-a}{d-b}$

B. $\frac{a-b}{c-d}$

C. $\frac{b-a}{c-d}$

D. $\frac{ad-bc}{c-d}$

E. $\frac{bc-ad}{c-d}$

4. $9 - a^2 - b^2 + 2ab =$

A. $(3-a-b)(3-a+b)$

B. $(3-a-b)(3+a-b)$

C. $(3-a-b)(3+a+b)$

D. $(3-a+b)(3+a-b)$

E. $(3-a+b)(3+a+b)$

5. If $\log(x+a) = 2$, then $x =$

A. $2 - a$

B. $100 - a$

C. $\frac{100}{a}$

D. $2 - \log a$

E. $100 - \log a$

6. If $2x^2 + x + m$ is divisible by $x - 2$, then it is also divisible by

A. $x + 3$

B. $2x - 3$

C. $2x + 3$

D. $2x - 5$

E. $2x + 5$

7. Which of the following is/are an identity/identities?

- I. $x^2 = 4$
- II. $(2x+3)^2 = 4x^2 + 12x + 9$
- III. $(x+1)^2 = x^2 + 1$

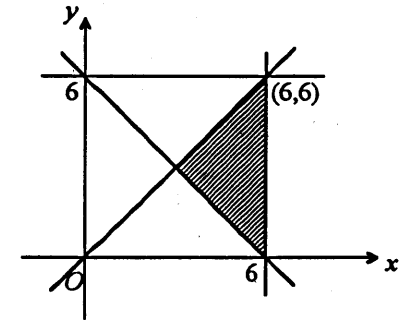
- A. I only
- B. II only
- C. III only
- D. I and II only
- E. II and III only

8. Solve
$$\begin{cases} \frac{3}{x} - y = 1 \\ 2y - \frac{1}{2x} = 1 \end{cases}$$

- A. $x = \frac{5}{4}, y = \frac{7}{4}$
- B. $x = \frac{11}{4}, y = \frac{1}{11}$
- C. $x = \frac{11}{4}, y = \frac{13}{22}$
- D. $x = \frac{11}{6}, y = \frac{7}{11}$
- E. $x = \frac{6}{11}, y = \frac{7}{11}$

9. Which of the following systems of inequalities has its solution represented by the shaded region in the figure?

- A.
$$\begin{cases} x + y \geq 6 \\ x \geq y \\ x \leq 6 \end{cases}$$
- B.
$$\begin{cases} x + y \geq 6 \\ x \geq y \\ y \leq 6 \end{cases}$$
- C.
$$\begin{cases} x + y \geq 6 \\ x \leq y \\ x \leq 6 \end{cases}$$
- D.
$$\begin{cases} x + y \geq 6 \\ x \leq y \\ y \leq 6 \end{cases}$$
- E.
$$\begin{cases} x + y \leq 6 \\ x \geq y \\ x \leq 6 \end{cases}$$



10. There are 1 200 students in a school, of which 640 are boys and 560 are girls. If 55% of the boys and 40% of the girls wear glasses, what percentage of students in the school wear glasses?

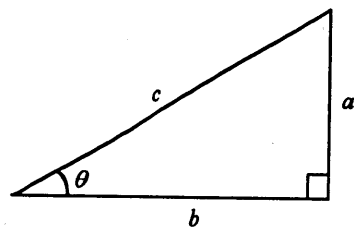
- A. 47%
- B. 47.5%
- C. 48%
- D. 52%
- E. 53%

11. In a map of scale 1 : 500, the length and breadth of a rectangular field are 2 cm and 3 cm respectively. Find the actual area of this field.

- A. 30 m²
- B. 150 m²
- C. 1 500 m²
- D. 3 000 m²
- E. 15 000 m²

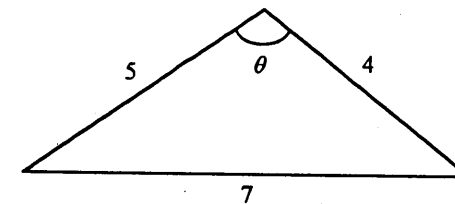
12. In the figure, $\sin \theta + \tan \theta =$

- A. $\frac{a}{c} + \frac{a}{b}$
- B. $\frac{a}{c} + \frac{b}{a}$
- C. $\frac{b}{c} + \frac{a}{b}$
- D. $\frac{b}{c} + \frac{b}{a}$
- E. $\frac{c}{a} + \frac{a}{b}$



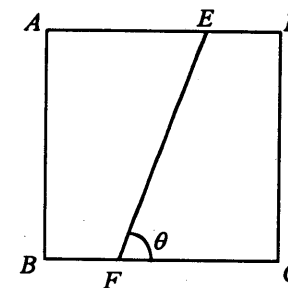
13. In the figure, find θ correct to the nearest degree.

- A. 78°
- B. 91°
- C. 102°
- D. 114°
- E. 125°



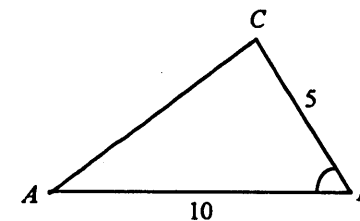
14. In the figure, the square sandwich ABCD is cut into two equal halves along EF so that AE : ED = 2 : 1. Find θ correct to the nearest degree.

- A. 56°
- B. 63°
- C. 64°
- D. 71°
- E. 72°



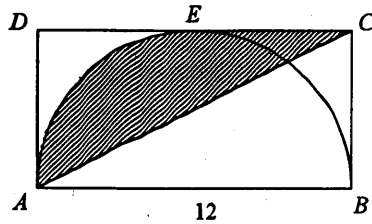
15. In the figure, the area of $\triangle ABC$ is 18. Find $\angle ABC$ correct to the nearest degree.

- A. 30°
- B. 44°
- C. 46°
- D. 60°
- E. 69°



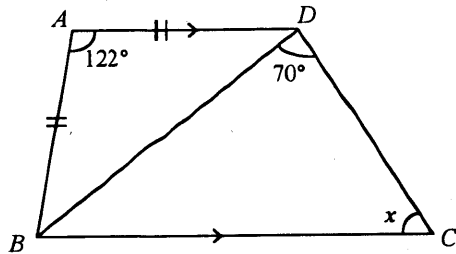
16. In the figure, BEA is a semicircle. $ABCD$ is a rectangle and DC touches the semicircle at E . Find the area of the shaded region.

- A. 9π
 B. 18π
 C. 36π
 D. $36 - 9\pi$
 E. $36 + 9\pi$



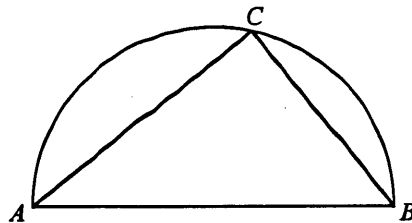
17. In the figure, find x .

- A. 52°
 B. 58°
 C. 61°
 D. 70°
 E. 81°



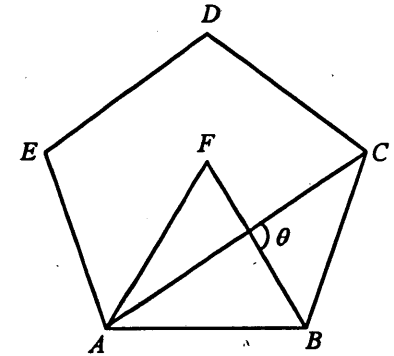
18. In the figure, BCA is a semicircle. If $AC = 6$ and $CB = 4$, find the area of the semicircle.

- A. $\frac{5}{2}\pi$
 B. $\frac{13}{2}\pi$
 C. 10π
 D. 13π
 E. 26π



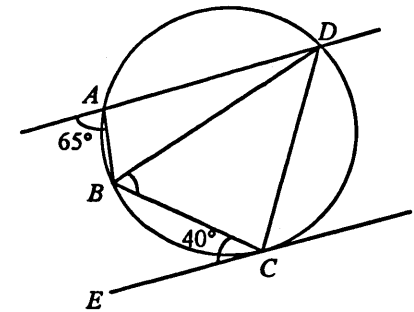
19. In the figure, $ABCDE$ is a regular pentagon and ABF is an equilateral triangle. Find θ .

- A. 66°
 B. 84°
 C. 90°
 D. 96°
 E. 108°



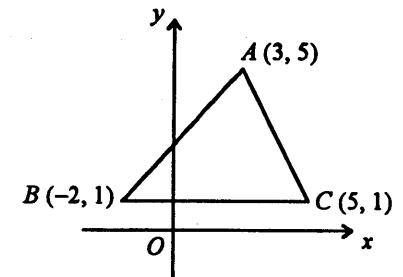
20. In the figure, EC is the tangent to the circle at C . Find $\angle CBD$.

- A. 40°
 B. 50°
 C. 65°
 D. 70°
 E. 75°



21. In the figure, find the area of $\triangle ABC$.

- A. 6
 B. 7.5
 C. 14
 D. 17.5
 E. 28



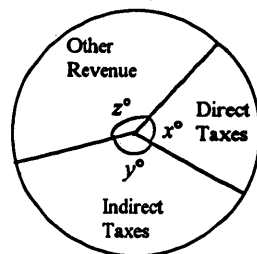
22. Which of the following lines is perpendicular to the line $\frac{x}{2} + \frac{y}{3} = 1$?

- A. $3x + 2y = 1$
- B. $3x - 2y = 1$
- C. $2x + 3y = 1$
- D. $2x - 3y = 1$
- E. $\frac{x}{2} - \frac{y}{3} = 1$

23. In the pie chart, if $x : y : z = 75 : 106 : 119$, find x .

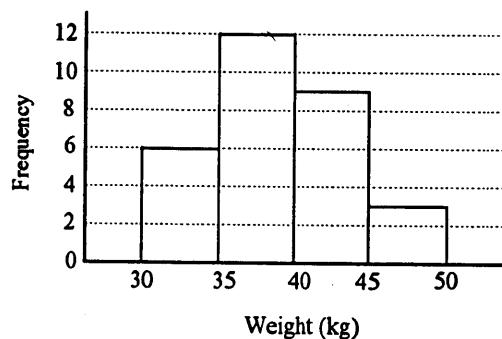
- A. 25
- B. 45
- C. 75
- D. 90
- E. 120

Total Government Revenue by Sources
in a certain year



24. The histogram below shows the distribution of the weights of 30 students. Find the mean weight of these students.

- A. 36.5 kg
- B. 38.5 kg
- C. 39 kg
- D. 39.5 kg
- E. 41.5 kg



25. Two fair dice are thrown. Find the probability that the sum of the two numbers shown is 8.

- A. $\frac{1}{4}$
- B. $\frac{1}{6}$
- C. $\frac{1}{11}$
- D. $\frac{1}{12}$
- E. $\frac{5}{36}$

26. In a test, there are 3 questions. For each question, the probability that John correctly answers it is $\frac{2}{5}$. Find the probability that he gets exactly 2 questions correct.

- A. $\frac{2}{3}$
- B. $\frac{4}{25}$
- C. $\frac{12}{25}$
- D. $\frac{12}{125}$
- E. $\frac{36}{125}$

27. If $f(x) = 3x^2 + bx + 1$ and $f(x) = f(-x)$, then $f(-3) =$

- A. -26.
- B. 0.
- C. 3.
- D. 25.
- E. 28.

28. Simplify $\frac{4}{x^2 - 4} - \frac{3}{x^2 - x - 2}$.

- A. $\frac{1}{(x+1)(x+2)}$
- B. $\frac{1}{(x+1)(x-2)}$
- C. $\frac{1}{(x-1)(x-2)}$
- D. $\frac{x+10}{(x+1)(x-2)(x+2)}$
- E. $\frac{x-10}{(x-1)(x-2)(x+2)}$

29. $\frac{1}{\sqrt{2}-1} - \frac{1}{\sqrt{3}-\sqrt{2}} =$

- A. $-1 + \sqrt{3}$.
- B. $1 - \sqrt{3}$.
- C. $-1 + 2\sqrt{2} - \sqrt{3}$.
- D. $1 - 2\sqrt{2} + \sqrt{3}$.
- E. $1 + 2\sqrt{2} - \sqrt{3}$.

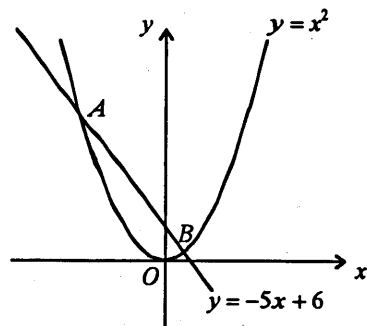
30. The difference of the roots of the equation $2x^2 - 5x + k = 0$ is $\frac{7}{2}$.

Find k .

-
- A. -6
 - B. -3
 - C. $-\frac{3}{2}$
 - D. 3
 - E. $\frac{51}{16}$

31. In the figure, find the coordinates of the mid-point of AB .

- A. $(-\frac{7}{2}, \frac{35}{2})$
- B. $(-\frac{5}{2}, \frac{25}{4})$
- C. $(-\frac{5}{2}, \frac{37}{2})$
- D. $(\frac{5}{2}, \frac{13}{2})$
- E. $(\frac{7}{2}, \frac{35}{2})$



32. Find the values of x which satisfy both $-2x < 3$ and $(x+3)(x-2) < 0$.

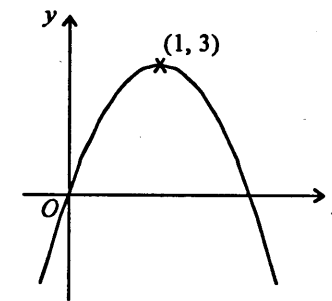
- A. $x < -3$
- B. $x > 2$
- C. $-3 < x < -\frac{3}{2}$
- D. $-\frac{3}{2} < x < 2$
- E. $x < -3$ or $x > -\frac{3}{2}$

33. If $a < b < 0$, then which of the following must be true?

- I. $a^2 < b^2$
 - II. $ab < a^2$
 - III. $\frac{1}{a} < \frac{1}{b}$
- A. I only
 - B. II only
 - C. III only
 - D. I and II only
 - E. I and III only

34. The figure shows the graph of a quadratic function $f(x)$. If the vertex of the graph is $(1, 3)$, then $f(x) =$

- A. $-3(x-1)^2 + 3$
- B. $-3(x+1)^2 + 3$
- C. $-(x-1)^2 + 3$
- D. $-(x+1)^2 + 3$
- E. $3(x-1)^2 - 3$



35. The n -th term of an arithmetic sequence is $3 + 2n$. Find the sum of the first 50 terms of the sequence.

- A. 103
- B. 2575
- C. 2700
- D. 2750
- E. 5400

36. The first term of a geometric sequence is a . If the sum to infinity of the sequence is $\frac{3}{4}a$, then its common ratio is

- A. $-\frac{1}{3}$
- B. $-\frac{1}{4}$
- C. $\frac{1}{4}$
- D. $\frac{1}{3}$
- E. $\frac{3}{4}$

37. a, b, c, d are 4 consecutive terms of a geometric sequence. Which of the following must be true?

I. $b^2 = ac$

II. $\frac{b}{a} = \frac{d}{c}$

III. $\frac{d}{a} = \left(\frac{c}{b}\right)^3$

- A. II only
- B. I and II only
- C. I and III only
- D. II and III only
- E. I, II and III

38. Find the interest on \$10 000 at 16% per annum for 2 years, compounded half-yearly. Give the answer correct to the nearest dollar.

- A. \$1664
- B. \$3456
- C. \$3605
- D. \$7424
- E. \$8106

39. Suppose x varies directly as y and inversely as z . When $y=2$ and $z=3$, $x=7$. When $y=6$ and $z=7$, $x=$

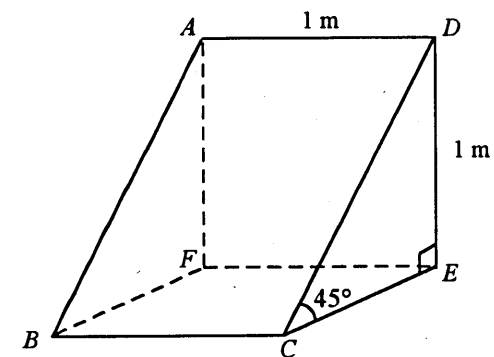
- A. 1.
- B. $\frac{49}{9}$.
- C. 9.
- D. $\frac{49}{4}$.
- E. 49.

40.
$$\frac{\cos(90^\circ - A) \sin(180^\circ - A)}{\tan(360^\circ - A)} =$$

- A. $-\sin A \cos A$.
- B. $\sin A \cos A$.
- C. $-\cos^2 A$.
- D. $\cos^2 A$.
- E. $\sin^2 A$.

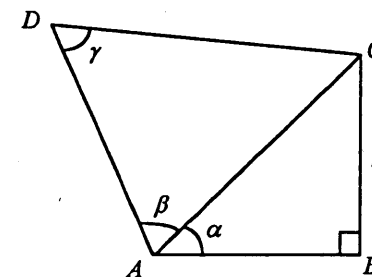
41. In the figure, $ABCD$ is a rectangle inclined at an angle of 45° to the horizontal plane $BCEF$. Find the inclination of AC to the horizontal plane correct to the nearest degree.

- A. 27°
- B. 30°
- C. 35°
- D. 45°
- E. 55°



42. In the figure, $CD =$

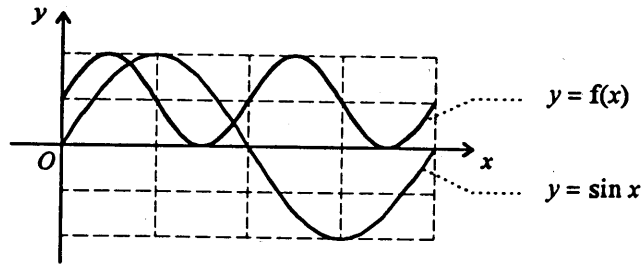
- A. $\frac{r \sin \beta}{\sin \alpha \sin \gamma}$
- B. $\frac{r \sin \beta}{\cos \alpha \sin \gamma}$
- C. $\frac{r \sin \alpha \sin \beta}{\sin \gamma}$
- D. $\frac{r \cos \alpha \sin \beta}{\sin \gamma}$
- E. $\frac{r \sin \beta}{\sin \alpha}$



43. For $0 \leq \theta \leq 2\pi$, how many roots does the equation $\tan \theta(\tan \theta - 2) = 0$ have?

- A. 1
- B. 2
- C. 3
- D. 4
- E. 5

44. In the figure, $f(x) =$



- A. $\sin \frac{x}{2} + \frac{1}{2}$
- B. $\sin 2x + \frac{1}{2}$
- C. $\frac{1}{2} \sin \frac{x}{2} + \frac{1}{2}$
- D. $\frac{1}{2} \sin x + \frac{1}{2}$
- E. $\frac{1}{2} \sin 2x + \frac{1}{2}$

45. The equation of a circle is given by $x^2 + y^2 - 4x + 6y - 3 = 0$. Which of the following statements is/are true?

- I. The centre of the circle is $(-2, 3)$.
- II. The radius of the circle is 4.
- III. The origin is inside the circle.

- A. I only
- B. I and II only
- C. I and III only
- D. II and III only
- E. I, II and III

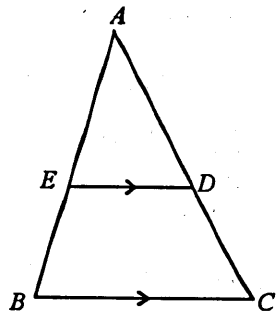
46. A circle has $(a, 0)$ and $(0, b)$ as the end points of a diameter. Which of the following points lie(s) on this circle?

- I. $(-a, -b)$
- II. $(0, 0)$
- III. (a, b)

- A. II only
- B. III only
- C. I and II only
- D. II and III only
- E. I, II and III

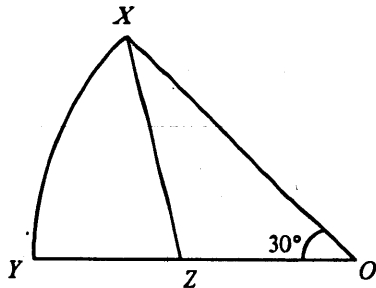
47. In the figure, AEB and ADC are straight lines. $ED \parallel BC$ and $ED : BC = 2 : 3$. If the coordinates of A and B are $(4, 7)$ and $(0, 1)$ respectively, find the coordinates of E .

- A. $(\frac{4}{3}, 3)$
 B. $(\frac{8}{3}, 5)$
 C. $(\frac{8}{5}, \frac{5}{17})$
 D. $(\frac{12}{5}, \frac{23}{5})$
 E. $(\frac{8}{7}, \frac{19}{7})$



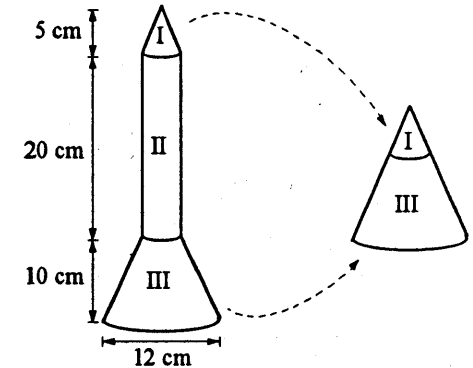
48. In the figure, OXY is a sector with centre O . If Z is the mid-point of YO , find area of $\triangle OXZ$: area of sector OXY .

- A. $1 : 2$
 B. $2 : \sqrt{3}\pi$
 C. $2 : 3\pi$
 D. $3 : 2\pi$
 E. $3\sqrt{3} : 2\pi$



49. In the figure, the rocket model consists of three parts. Parts I and III can be joined together to form a right circular cone. Part II is a right cylinder. Find the volume of the rocket model.

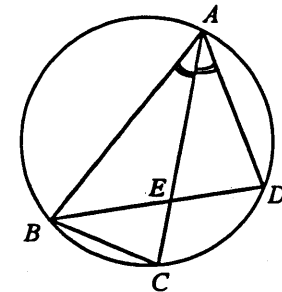
- A. $260\pi \text{ cm}^3$
 B. $360\pi \text{ cm}^3$
 C. $620\pi \text{ cm}^3$
 D. $720\pi \text{ cm}^3$
 E. $900\pi \text{ cm}^3$



50. In the figure, AC is the angle bisector of $\angle BAD$. Which of the following statements must be true?

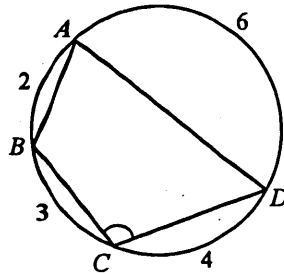
- I. $\triangle BCE \sim \triangle ADE$
 II. $\triangle ABC \sim \triangle AED$
 III. $\triangle ABC \sim \triangle BDA$

- A. I only
 B. I and II only
 C. I and III only
 D. II and III only
 E. I, II and III



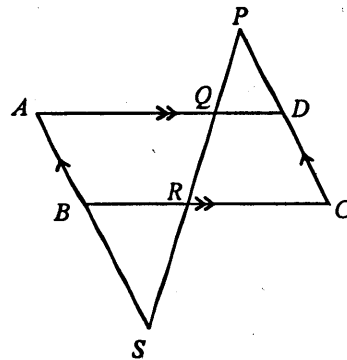
51. In the figure, $\widehat{AB} = 2$, $\widehat{BC} = 3$, $\widehat{CD} = 4$ and $\widehat{DA} = 6$. Find $\angle BCD$.

- A. 72°
 B. 84°
 C. 90°
 D. 96°
 E. 144°



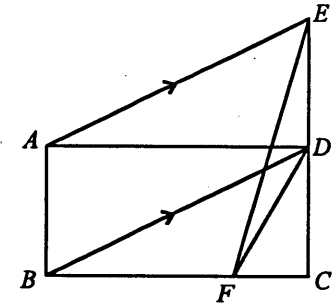
52. In the figure, $ABCD$ is a parallelogram. PDC , $PQRS$ and ABS are straight lines. If $AQ = 4$, $QD = 2$ and $BR = RC = 3$, then $PQ : QR : RS =$

- A. $1 : 1 : 1$.
 B. $1 : 2 : 6$.
 C. $2 : 1 : 3$.
 D. $2 : 3 : 4$.
 E. $8 : 12 : 9$.



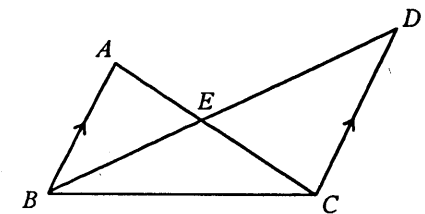
53. In the figure, $ABCD$ is a rectangle. CDE is a straight line and $AE \parallel BD$. If the area of $ABCD$ is 24 and F is a point on BC such that $BF : FC = 3 : 1$, find the area of $\triangle DEF$.

- A. 2
 B. 3
 C. 4
 D. 6
 E. 8



54. In the figure, $AB \parallel DC$. If the areas of $\triangle ABE$ and $\triangle CDE$ are 4 and 9 respectively, find the area of $\triangle BCE$.

- A. 4
 B. 5
 C. 6
 D. 6.5
 E. 9



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