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	$= \pi rl$
	Volume	$= \frac{1}{3}\pi r^2 h$
PRISM	Volume	= base area × height
PYRAMID	Volume	$= \frac{1}{3}$ × base area × 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.

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

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

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. $2x+5$.

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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. $x = \frac{5}{4}, \quad y = \frac{7}{4}$

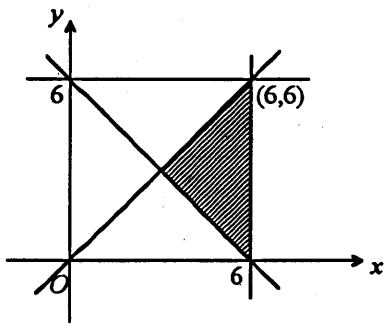
B. $x = \frac{11}{4}, \quad y = \frac{1}{11}$

C. $x = \frac{11}{4}, \quad y = \frac{13}{22}$

D. $x = \frac{11}{6}, \quad y = \frac{7}{11}$

E. $x = \frac{6}{11}, \quad y = \frac{7}{11}$

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%

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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. $30\ m^2$

B. $150\ m^2$

C. $1\,500\ m^2$

D. $3\,000\ m^2$

E. $15\,000\ m^2$

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

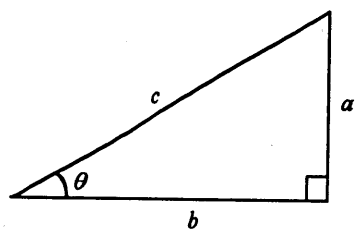
A. $\frac{a}{c}+\frac{a}{b}$.

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.

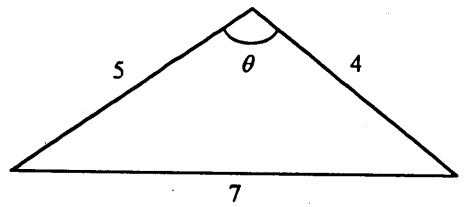
A. $78°$

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.

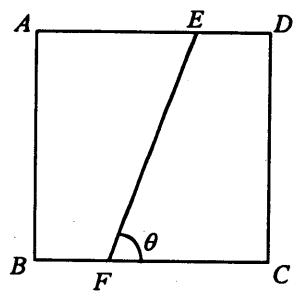
A. $56°$

B. $63°$

C. $64°$

D. $71°$

E. $72°$



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

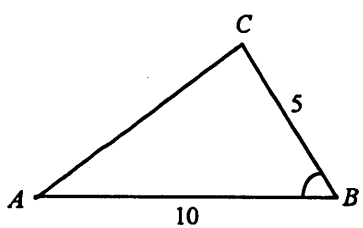
A. $30°$

B. $44°$

C. $46°$

D. $60°$

E. $69°$



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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.

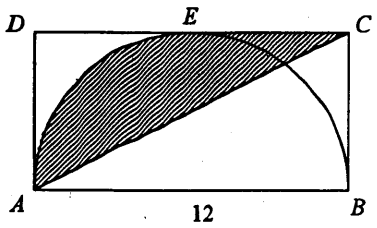
A. 9π

B. 18π

C. 36π

D. $36 - 9\pi$

E. $36 + 9\pi$



17. In the figure, find x.

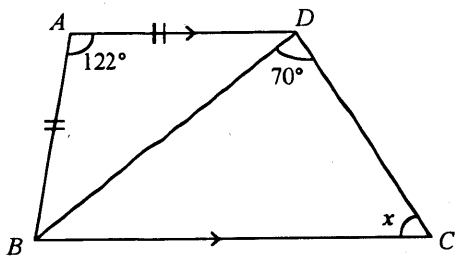
A. 52°

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.

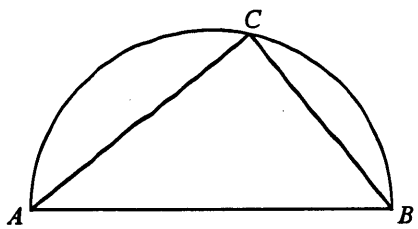
A. $\frac{5}{2}\pi$

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.

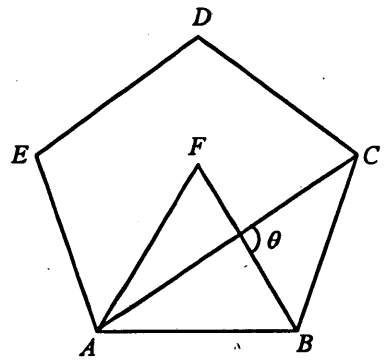
A. 66°

B. 84°

C. 90°

D. 96°

E. 108°



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

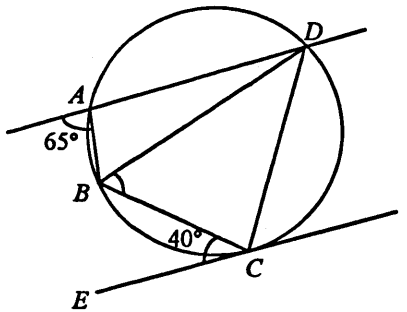
A. 40°

B. 50°

C. 65°

D. 70°

E. 75°



21. In the figure, find the area of ΔABC.

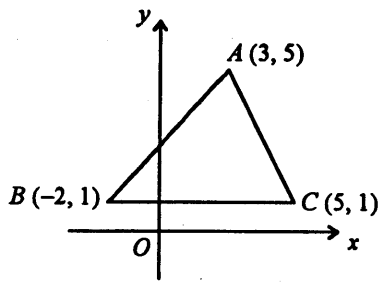
A. 6

B. 7.5

C. 14

D. 17.5

E. 28



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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

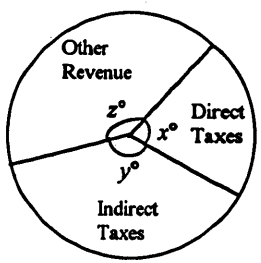
B. 45

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.

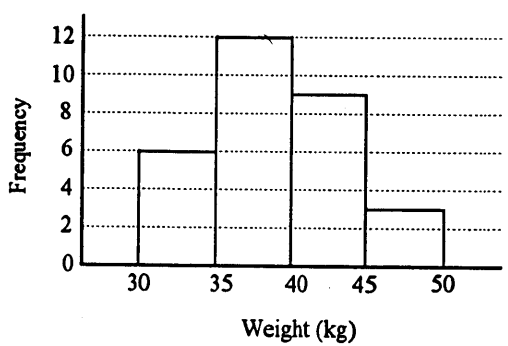
A. 36.5 kg

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. $\frac{36}{125}$

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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. $\frac{51}{16}$

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

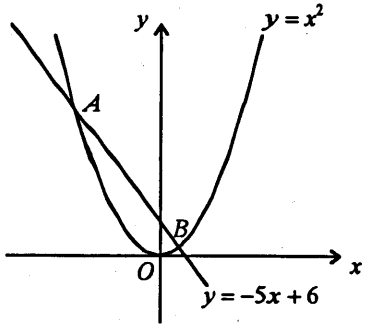
A. $(-\frac{7}{2}, \frac{35}{2})$

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 $f(x) =$

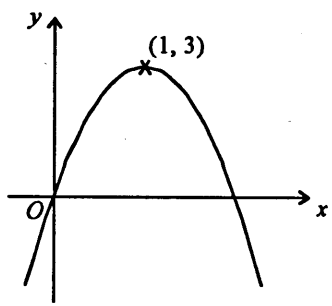
A. $-3(x-1)^2+3$.

B. $-3(x+1)^2+3$.

C. $-(x-1)^2+3$.

D. $-(x+1)^2+3$.

E. $3(x-1)^2-3$.



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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

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

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.

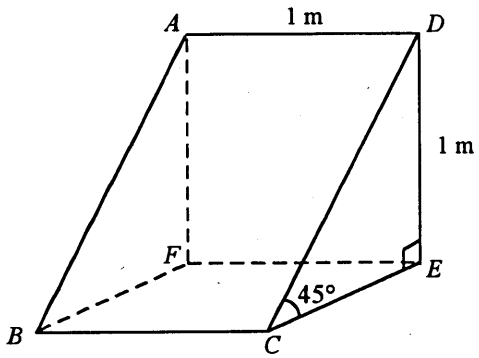
A. 27°

B. 30°

C. 35°

D. 45°

E. 55°



42. In the figure, $CD =$

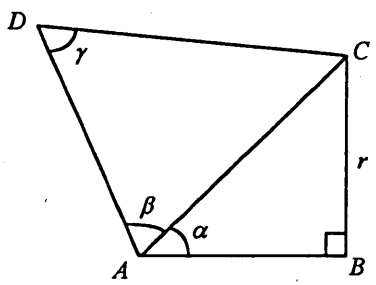
A. $\frac{r\sin\beta}{\sin\alpha\sin\gamma}$.

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. $\frac{r\sin\beta}{\sin\alpha}$.



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

A. 1

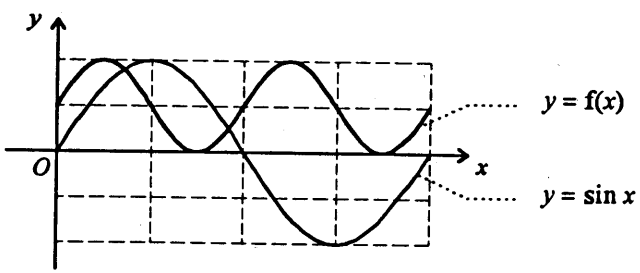
B. 2

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

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

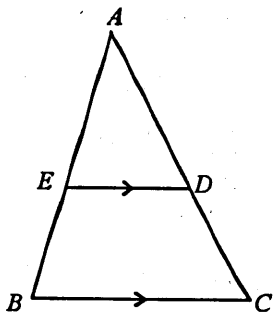
A. $(\frac{4}{3}, 3)$

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 ΔOXZ : area of sector OXY.

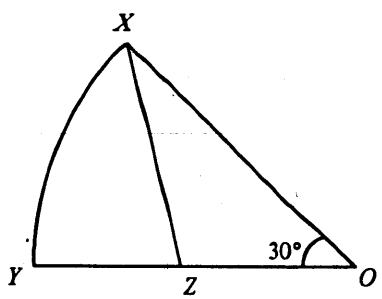
A. 1 : 2

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.

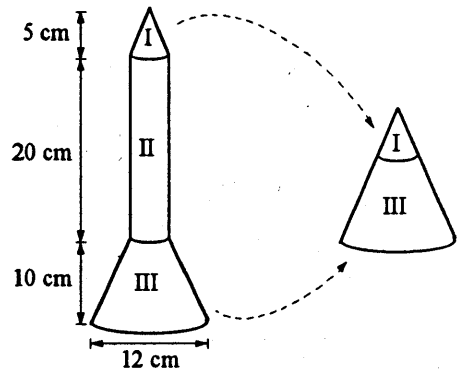
A. 260π cm^3

B. 360π cm^3

C. 620π cm^3

D. 720π cm^3

E. 900π cm^3



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

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

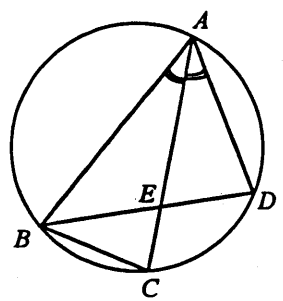
A. I only

B. I and II only

C. I and III only

D. II and III only

E. I, II and III



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

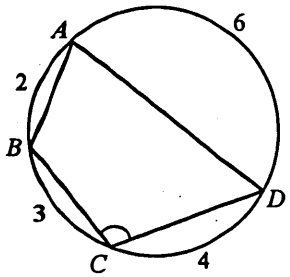
A. 72°

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 $PQ : QR : RS =$

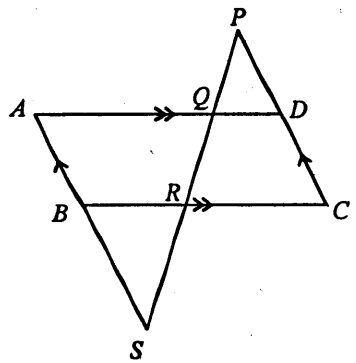
A. 1 : 1 : 1.

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 $AE // BD$. If the area of $ABCD$ is 24 and F is a point on BC such that $BF : FC = 3 : 1$, find the area of ΔDEF.

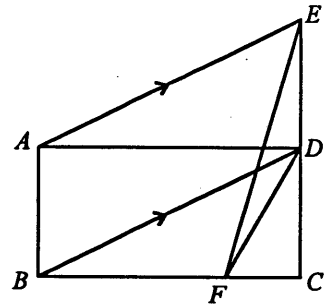
A. 2

B. 3

C. 4

D. 6

E. 8



54. In the figure, $AB // DC$. If the areas of ΔABE and ΔCDE are 4 and 9 respectively, find the area of ΔBCE.

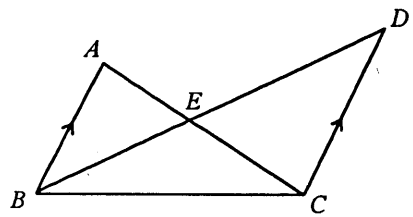
A. 4

B. 5

C. 6

D. 6.5

E. 9



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