### Exercise 17.   Volumes of solids of revolution

(Answers are in cubic units and in terms of $\pi$.)

In Problems 1 to 5, determine the volume of the solid of revolution formed by revolving the areas enclosed by the given curve, the $x$-axis and the given ordinates through one revolution about the $x$-axis.

1.  $y = 5x$;   $x = 1, x = 4$

2.  $y = x^2$;   $x = -2, x = 3$

3.  $y = 2x^2 + 3$;   $x = 0, x = 2$

4.  $\dfrac{y^2}{4} = x$;   $x = 1, x = 5$

5.  $xy = 3$;   $x = 2, x = 3$

In Problems 6 to 8, determine the volume of the solid of revolution formed by revolving the areas enclosed by the given curves, the $y$-axis and the given ordinates through one revolution about the $y$-axis.

6.  $y = x^2$;   $y = 1, y = 3$

7.  $y = 3x^2 - 1$;   $y = 2, y = 4$

8.  $y = \dfrac{2}{x}$;   $y = 1, y = 3$

**Exercise 18.  Volumes of solids of revolution**
(Answers to volumes are in cubic units and in terms of $\pi$.)

In Problems 1 and 2, determine the volume of the solid of revolution formed by revolving the areas enclosed by the given curve, the $x$-axis and the given ordinates through one revolution about the $x$-axis.

1.  $y = 4e^x$;  $x = 0$;  $x = 2$

2.  $y = \sec x$;  $x = 0$,  $x = \dfrac{\pi}{4}$

In Problems 3 and 4, determine the volume of the solid of revolution formed by revolving the areas enclosed by the given curves, the $y$-axis and the given ordinates through one revolution about the $y$-axis.

3.  $x^2 + y^2 = 16$;  $y = 0$, $y = 4$

4.  $x\sqrt{y} = 2$;  $y = 2$, $y = 3$

5.  Determine the volume of a plug formed by the frustum of a sphere of radius 6 cm which lies between two parallel planes at 2 cm and 4 cm from the centre and on the same side of it.
    (The equation of a circle, centre 0, radius $r$ is $x^2 + y^2 = r^2$.)

6.  The area enclosed between the two curves
    $x^2 = 3y$ and $y^2 = 3x$ is rotated about the $x$-axis. Determine the volume of the solid formed

7.  The portion of the curve $y = x^2 + \dfrac{1}{x}$ lying
    between $x = 1$ and $x = 3$ is revolved 360° about the $x$-axis. Determine the volume of the solid formed
    Calculate the volume of the frustum of a sphere of radius 5 cm that lies between two parallel planes at 3 cm and 2 cm from the centre and on opposite sides of it