

- (1) (Page 8, Problem 35) The demand function for a certain product, $q = D(p)$, is linear, where p is the price per item in dollars and q is the quantity demanded. If p increases by \$5, market research shows that demand drops by 2 items. In addition, 100 items are purchased if the price is \$550.
- (a) Find a formula for
- (i) q as a linear function of p .
 - (ii) p as a linear function of q .
- (b) Draw a graph with q on the horizontal axis.

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(2) (Page 15, Problem 23) The atmospheric pressure is decreasing as you climb higher and higher. The Earth's atmospheric pressure is 1013 millibars at sea level, and 750 millibars 2 kilometers above sea level. Answer the following questions. You must show all your work.

(a) Suppose the atmospheric pressure decreases exponentially with the elevation above sea level. What is the atmospheric pressure at 5 km above sea level?

(b) Suppose the atmospheric pressure decreases linearly with the elevation above sea level. What is the atmospheric pressure at 5 km above sea level?

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(3) (Page 27, Problem 33) Find $f^{-1}(P)$, where

$$P = f(t) = 200(1.04)^t$$

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(4) (Sequential 3, 1998, Properties of logarithms)

(a) Given: $\log_b(3) = p$ and $\log_b(5) = q$,

(i) Express $\log_b\left(\frac{9}{5}\right)$ in terms of p and q .

(ii) Express $\log_b(\sqrt[3]{15})$ in terms of p and q .

(b) Solve for x :

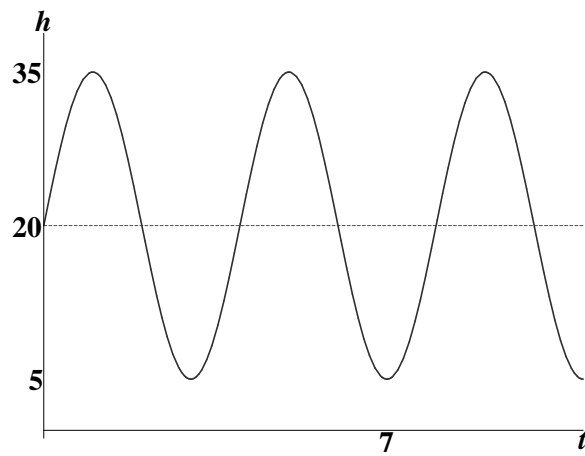
(i) $\log_4(x^2 + 3x) - \log_4(x + 5) = 1$

(ii) $7(3.2)^x = 2.1(15)^{2x}$

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(5) (Page 35, Problems 15-26)

Find a possible formula for the sinusoidal function graphed below:



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(6) (Page 43, Problem 22) Poiseuille's law gives the rate, R , of a gas through cylindrical pipe in terms of the radius of the pipe, r , for a fixed drop in pressure between the two ends of the pipe.

(a) Find a formula for Poiseuille's Law, given that the rate of the flow is ***proportional*** to the fourth power of the radius.

(b) If $R = 400 \text{ cm}^3/\text{sec}$ in a pipe of radius 3 cm for a certain gas, find a formula for the rate of flow of that gas through a pipe of radius r cm.

(c) What is the rate of flow of the same gas through a pipe with a 5cm radius?

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(7) Circle the **ONE** alternative that best answers the question.

(a) (Properties of logarithm) Find the domain of the function $f(x) = \log(\log x)$.

- (i) $(0, \infty)$
- (ii) $(1, \infty)$
- (iii) $(10, \infty)$
- (iv) none of the above

(b) (Properties of logarithm) Change the exponential expression $5(1.03)^x = 8$ to an equivalent expression involving a logarithm.

- (i) $x \log(5.15) = \log(8)$
- (ii) $x \log(1.03) = \log(1.6)$
- (iii) $\log(5) \log(1.03^x) = \log(8)$
- (iv) $5x \log(1.03) = \log(8)$

(c) (Page 22, Problem 3) The surface area of a balloon is given by $S(r) = 4\pi r^2$, where r is the radius of the balloon. If the radius is increasing with time t , as the balloon is being blown up, according to the formula $r(t) = \frac{4}{5}t^3$, $t \geq 0$, find the surface area S as a function of the time t .

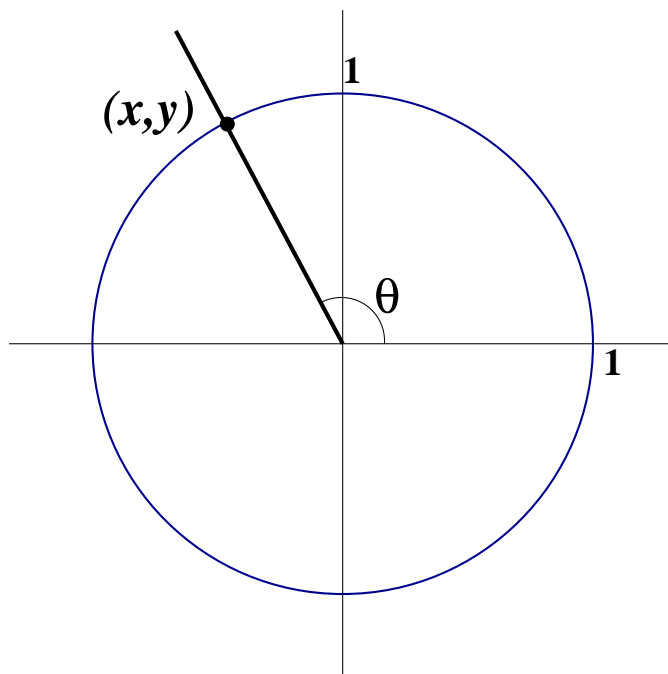
- (i) $S = \frac{64}{25}\pi t^3$
- (ii) $S = \frac{16}{25}\pi t^6$
- (iii) $S = \frac{64}{25}\pi t^6$
- (iv) $S = \frac{64}{25}\pi t^9$

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(8) (Sequential III, 2003, Basic Trigonometry)

- (a) An angle of $2\frac{1}{4}$ radians at the center of the circle intercepts an arc of 18 inches. Find the length of the radius in inches.

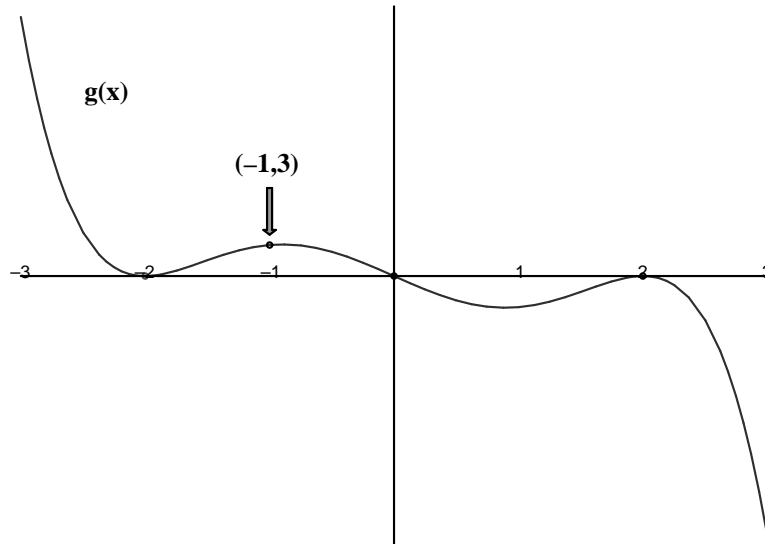
- (b) In the accompanying diagram of a unit circle, the ordered pair (x, y) represents the point where the terminal side of θ intersects the unit circle.



If $x = -\frac{1}{2}$, what is one possible value for θ ?

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- (9) (Page 43, Problems 10-13) Give **one** possible formula for the polynomial graphed below.



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(10) (Page 337, Problems 53–62) Assume that $f(x) = \sqrt[3]{4x^2 + 2x}$ and that $g(x) = 2x$.

(a) Find a formula for $f(g(x))$. Simplify your answer.

(b) If $f(x) = j(g(x))$, find a formula for $j(x)$.