CALCULUS MPT
SAMPLE QUESTIONS

Important Note: Calculators are not permitted when writing the Math Placement Test. In order to fully benefit from these practice problems, you should solve them without the aid of a calculator.

Algebra:

Topics Polynomials; factoring; rational expressions; radicals; exponents; applications.

1. Simplify: $\dfrac{y}{x+y}-\dfrac{x}{x-y}+\dfrac{y^2}{x^2-y^2}$

2. Simplify: $\dfrac{\dfrac{x+h}{x+h+5}-\dfrac{x}{x+5}}{h}$

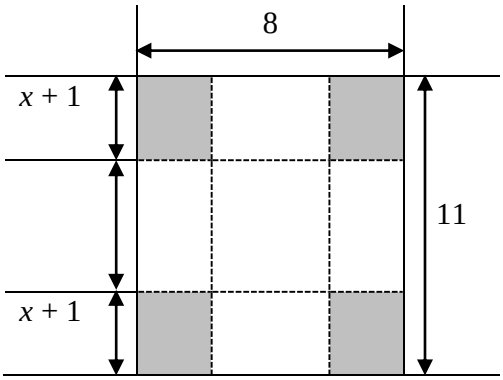
3. Simplify: $\sqrt[3]{16x^6y^8}$

4. Simplify: $\dfrac{x^{-2}-y^{-2}}{x^{-1}+y^{-1}}$

5. Simplify: $\dfrac{1}{2}x^{-1/2}(x+1)^{2/3}+\dfrac{2}{3}x^{1/2}(x+1)^{-1/3}$

6. Rationalize the numerator and simplify: $\dfrac{\sqrt{2+3(x+h)}-\sqrt{2+3x}}{h}$

7. The shaded corner squares are cut from the rectangle shown and the remaining piece is folded along the dashed lines to create an open top box. Express the volume of the box in terms of x.



Equations and Inequalities

Topics Solving equations and inequalities for linear, quadratic, and factored forms; equation of a line; applications.

8. Solve for x in each of the following:

(a) $\dfrac{ax+b}{c} - 2x = \dfrac{x}{a+c}$

(b) $\dfrac{3}{x-1} + \dfrac{2}{x+1} = \dfrac{2x+3}{3x-3}$

(c) $x^{-1} + x^{-2} = 2$

(d) $x - \sqrt{9-x} = 7$

(e) $x^4 - 6x^2 + 8 = 0$

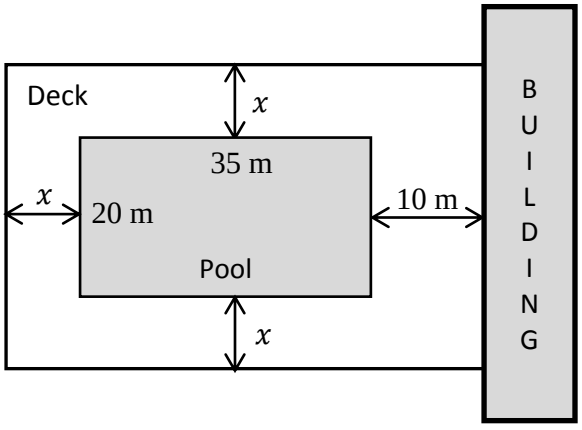
(f) $|8-5x| > 12$

(g) $(2x-3)(x^2+6x+9) \geq 0$

(h) $\dfrac{5x+2}{2x-1} \leq 4$

9. In slope-intercept form, find the equation of the line which passes through the point (2, 3) and is perpendicular to the line given by $y = 5x + 1$.

10. A swimming pool is positioned 10 meters away from a building as diagrammed. The fenced deck around the pool has an area equal to the surface area of the pool.
What is the width x of the deck around the pool?



Functions

Topics Function definition; domain; range; geometric interpretation; composition; inverse functions; basic building-block functions; piecewise-defined functions; function models.

11. Given $f(x) = 5 + \dfrac{3}{2x+1}$ find:

    (a) $f(3x)$ (b) $3f(x)$ (c) $f(x+h)$ (d) $\dfrac{f(x+h)-f(x)}{h}$

12. Find the domain of $f(x) = \sqrt{\dfrac{2x+1}{x+3}}$.

13. Express the area of an equilateral triangle as a function of its side length, x.

14. Use the graph of the function f to find

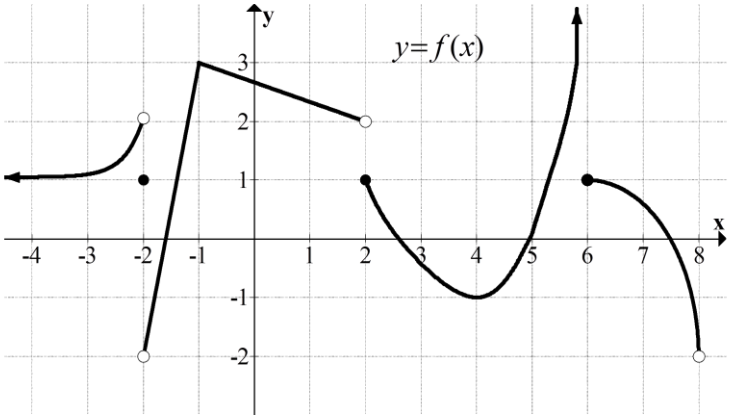
    (a) the domain of f

    (b) the range of f

    (c) $f(2)$

    (d) $f(0)$

    (e) $f(-2)$



15. The function f is defined below:

$$f(x) = \begin{cases} 2-x, & x \le 1 \\ 2, & 1 < x \le 4 \\ \sqrt{x}, & x > 4 \end{cases}$$

(a) Find the domain of *f*. (b) Find the range of *f*. (c) Sketch the graph of *f*.

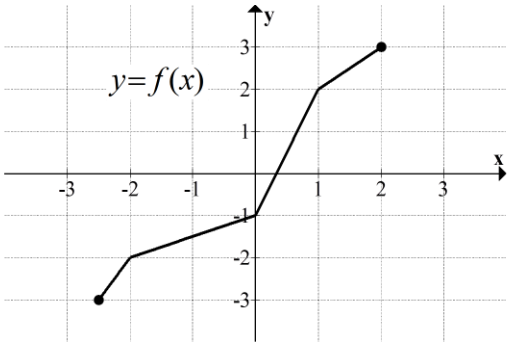
16. For $f(x) = \dfrac{x}{x-3}$ and $g(x) = \sqrt{x+2}$ find:

    (a) $(f \circ g)(x)$ (b) $(g \circ f)(x)$ (c) Domain of $f \circ g$ and $g \circ f$

17. Find the inverse of the function

    $f(x) = 4 + \sqrt{7-x}$.

18. Sketch the graph of the inverse function $y = f^{-1}(x)$ for the function f shown to the right.



Exponential and Logarithmic Functions

Topics Definitions; properties; applications.

19. Sketch the graph of $g(x) = 12 - 3^x$.

20. Expand and simplify: $\left(e^x + e^{-x}\right)^2$

21. Solve for *x*: $\log_b(x+1) + \log_b(x) = \log_b(3x+1)$

22. Find the domain of $g(x) = \log_2\left(\dfrac{x+3}{2x-5}\right)$.

23. Find the inverse of $f: \ f(x) = 2 + e^{3-x}$.

24. Simplify: $\ln\left(2e^{3x+1}\right)$

25. Solve for *x*: $e^x + 3e^{-x} = 4$

26. A company uses an exponential depreciation model for its machinery.

$V(t) = V_0 e^{kt}$; $V(t)$ = value at time *t*

A piece of machinery initially valued at $100,000 depreciates to $60,000 after 5 years. What is its depreciated value after 10 years?

Trigonometry

Topics Degree and radian angular measure: right triangle trigonometry; definition of the trigonometric functions of any angle; graphs; basic identities; applications.

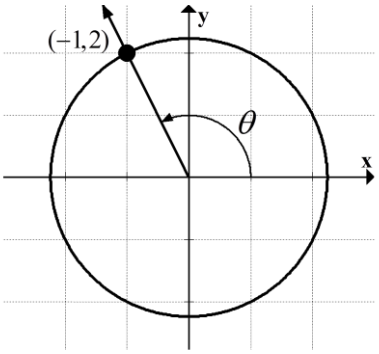
27. In standard position sketch (approximately) the angle which measures 4 radians.

28. For the diagrammed angle

$\cos(\theta) =$

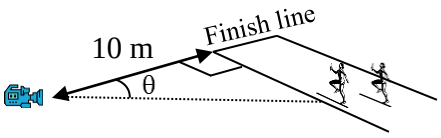
$\sin(\theta) =$

$\tan(\theta) =$



29. Evaluate the following: (a) $\cos(90°)$ (b) $\sin\left(\frac{\pi}{2}\right)$ (c) $\sec(\pi)$

30. A television crew is filming a race 10 m from a track's finish line.
(a) When the camera angle θ measures 40°, how far is the lead runner from the finish line?
(b) Express the distance between the lead runner and the finish line as a function of θ.



31. If $\tan(\theta) = 2$ and $\sin(\theta) < 0$,
(a) In which quadrant does θ terminate?
(b) Find the exact values for $\sin(\theta)$ and $\cos(\theta)$.

32. Factor and simplify: $\sin^3(x)\cos(x) + \sin(x)\cos^3(x)$

33. How is the graph of $y = 3\sin(4x)$ related to the graph of $y = \sin(x)$?

34. Solve: $\sin(x) = \frac{1}{2}$, $0 \le x \le 2\pi$