

PRACTICE PROBLEMS
FOR
MATHEMATICS PLACEMENT EXAMINATION (MPE)

Revised April 1998

When you come to New Mexico State University, you may be asked to take a mathematics placement examination (MPE) unless you have mathematics credit from another post secondary institution or you have Advanced Placement Credit for Mathematics.

The MPE will help to determine in what mathematics course you will be placed. Your Math ACT (ACTM) score will also be a factor in your placement as well as your high school grade point average.

If you are dissatisfied with your initial placement, you may choose to take the MPE and try to raise your placement.

If you wish to enroll in Math 191 (the calculus series) you must take the MPE and achieve a qualifying score.

The problems on this practice exam will help you review your mathematical skills and give you an idea of what you may expect to find on the test. The actual test is multiple choice in form and has 40 problems broken down as follows:

1. Placement information/form identification

Part I	2-11	Algebra I
Part II	12-21	Algebra II
Part III	22-31	Precalculus Algebra
Part IV	32-41	Trigonometry

These sample problems are grouped in a similar manner.

There are more practice problems than there are problems on the actual test.

You may use your own calculator during the test, but a calculator is neither required nor necessary.

Good Luck!

PRACTICE PROBLEMS-Review of Basic Skills

The first 22 problems given here are a review of basic arithmetic and algebra skills. While not directly tested on the Mathematics Placement Examination (MPE), the knowledge of these skills is essential for the concepts that are tested.

1. Add: $740 + 63 + 4820 + 29640$
2. Subtract: $6,492,000 - 3,284$
3. Multiply: 276×923
4. Divide: $3,587 \div 7$
5. Find all positive factors of 12.
6. Simplify: a) $2^3 \times 5^2$ b) $3^2 \div 5^3$
7. Simplify: $7 + (9 - 5) \times 3$
8. Add: $4\frac{3}{5} + 6\frac{3}{5}$
9. Subtract: $8\frac{2}{3} - 2\frac{6}{7}$
10. Multiply: $2\frac{1}{3} \times 8\frac{1}{4}$
11. Divide: $2\frac{1}{3} \div 5\frac{1}{4}$
12. A carpenter is dividing a board $\frac{3}{4}$ yard long into 9 equal pieces. What is the length of each piece in yards?
13. If $4\frac{1}{3}$ yards of paper are cut from an $18\frac{2}{5}$ yard roll, how many yards are left?
14. True or False: $\frac{5}{12} < \frac{7}{15}$
15. Simplify: $\left(\frac{3}{8}\right)^2 \div \left(\frac{3}{7} + \frac{3}{14}\right)$
16. Add: $174.281 + 0.943 + 69.876$
17. Subtract: $70.2 - 0.789$
18. Multiply: 29.87×4.3
19. Divide: $217.5 \div 2.9$
20. 7% of 42 is?
21. What percent of 64 is 72?
22. A store sells 12 oz. of Brand A for \$1.20 and 16 oz. of brand B for \$1.50. Which is the most economical buy?

PRACTICE PROBLEMS FOR PART I – Algebra I

23. Solve: $\frac{8}{17} = \frac{36}{x}$
24. $|(-1) \times 3| =$
25. If $z = \left(\frac{2}{3}\right)(x - 12)$ and $x = 39$, what is z ?
26. Translate into a mathematical expression: The product of c and one fourth c .
27. Translate into a mathematical expression: The quotient of r and the sum of 8 and r .
28. Collect like terms: $5a^2bc - 4ab^2c + 3ab^2c^3 + 6a^2bc - ab^2c^3$
29. Subtract: $(11x^2y^3 - 3xy^2 + 5) - (8xy^2 - 2x^2y^2 + 4)$
30. Multiply: $(a - 3b^2)(a + 3b^2)$
31. Simplify: $10x + 7(x - z) - z =$
32. If $\frac{9}{z} = \frac{4}{3}$, then $z =$
33. Simplify: $\frac{5}{5 + \frac{1}{4}} =$
34. If $x = 6$ and $y = 8$, then $|x - y| =$
35. Factor: $x^2 - 9x + 20$
36. The formula for converting Centigrade (C) temperature to Fahrenheit (F) is given by the formula $F = \frac{9}{5}C + 32$. What temperature in Centigrade will produce a temperature of 98° Fahrenheit?
37. Rationalize the denominator: $\frac{\sqrt{2}}{\sqrt{3}}$
38. Thirteen more than eight times a number is the same as two less than eleven times the number. Set up the appropriate equation and solve for the number.

PRACTICE PROBLEMS FOR PART II – Algebra II

39. Simplify: $\frac{3y^2 + 12y - 36}{y^2 - 16} \cdot \frac{y - 4}{y + 6}$
40. Simplify: $\frac{4}{x^2 - 36} + \frac{2}{x + 6} - \frac{1}{x - 6}$
41. Solve: $\frac{x}{x - 2} - \frac{3}{x - 1} = 1$
42. Solve for a: $\frac{1}{A} = \frac{1}{a} + \frac{1}{b}$
43. Simplify: $\frac{(-5x^{-2}y^{-2}z)^2}{(10^{-1}xyz^2)^{-3}}$
44. Simplify: $2x\sqrt{12xy^2} - y\sqrt{75x^3}$
45. Simplify: $\sqrt[3]{64x^5y^4z^6}$
46. Write under a single radical and simplify: $\frac{\sqrt[3]{54a^7d^5}}{\sqrt[3]{2ad}}$
47. Graph, label at least two points: $3x - 2y = -6$
48. Find an equation of the line containing $(-2, -3)$ and parallel to $3x + 2y = 6$. Write your answer in slope-intercept form.
49. Graph the function $f(x) = -x^2 + 4x - 3$. Find the intercepts. Label the vertex and at least three other points on the graph.
50. Graph $x = y^2 + 2y - 4$
51. If ${}^1\log_3 27 = x$, then $x =$
52. Solve: $\begin{cases} x + y = 10 \\ y = x + 8 \end{cases}$
53. Graph: $x^2 + y^2 = 9$
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PRACTICE PROBLEMS FOR PART III – Precalculus Algebra

54. Simplify: $125^{1/3}9^{-1/2}$
55. Find the distance between the points (-3,1) and (1,4) plotted on a rectangular coordinate system.
56. Write $|x - 5| \geq 4$ as a statement of union or intersection, whichever is appropriate.
57. Write $|x - 5| \leq 4$ as a statement of union or intersection, whichever is appropriate.
58. If $f(x) = \frac{4x + 3}{x + 2}$, then find $f(a + 3)$.
59. Factor the following, if possible, over the real numbers:

$$a^2 - b^2 \quad a^2 + b^2 \quad a^3 - b^3 \quad a^3 + b^3$$

60. Express the surface area of a cylinder with a closed bottom and open top in terms of the radius r of the base and the height h .
61. Express the surface area of a cube in terms of its side s .
62. Graph the parabola $f(x) = 4x^2 - 3$. Describe the value of $f(x)$ when $x < 0$, $x > 0$, and $x = 0$.
63. Graph: $f(x) = 3^x$
64. Graph: $f(t) = 5^{-t}$
65. Graph: $y = 4 + a^{-x}; a > 1$
66. The length, L , of a certain rectangle is four feet more than three times its width, W . The perimeter of the rectangle is 300 feet. Set up a system of equations that will allow you to solve for the length and width and then find those dimensions.
67. The area of a right triangle is 266.5 square inches. The height (h) of the triangle is two inches greater than three times the base (b). Set up a system of equations that will allow you to solve for the base and height and then find those dimensions.
68. The length, L , of a rectangle is twice more than its width, W . The area of the rectangle is 30 square feet. Set up a system of equations that will allow you to solve for the length and the width and then find those dimensions.
69. Solve: $\log_2(2x - 3) = 3$

PRACTICE BROBLEMS FOR PART IV – Trigonometry

70. Use the fundamental identities to find the remaining five trigonometric functions of θ

given that $\sin \theta = \frac{1}{x}$ and $\cos \theta > 0$ and $0^\circ \leq \theta \leq 180^\circ$ (rationalize denominator; simplify):

a) $\sin \theta = \frac{1}{x}$	d) $\csc \theta =$ _____
b) $\cos \theta =$ _____	e) $\sec \theta =$ _____
c) $\tan \theta =$ _____	f) $\cot \theta =$ _____

71. Find the exact number of radians in 315° , then estimate to 3 decimal places.

72. Which one of the following numbers is the largest?

$$\tan 0^\circ \quad \tan 30^\circ \quad \tan 135^\circ \quad \tan 180^\circ \quad \tan 225^\circ \quad \tan 330^\circ$$

73. Graph one cycle of $y = \cos(2x)$ beginning at 0 where x is in radians.

74. What is the value of $\csc(90^\circ - \theta)$?

75. Solve for exact solutions in the interval $[0, 2\pi)$: $\cot 3x = 1$

76. Complete the following identities:

a) $\sin^2 \theta + \cos^2 \theta =$ _____	f) $\sec\left(\frac{\pi}{2} - x\right) =$ _____
b) $\tan^2 \theta + 1 =$ _____	g) $\tan\left(\frac{\pi}{2} - x\right) =$ _____
c) $1 + \cot^2 \theta =$ _____	h) $\sin 2\theta =$ _____
d) $\frac{\sin A}{a} = \frac{?}{b}$, _____	i) $\cos 2\theta =$ _____
e) $\sin\left(\frac{\pi}{2} - x\right) =$ _____	j) $\tan 2\theta =$ _____

77. Given an angle θ

a. If θ is an angle such that $0^\circ \leq \theta \leq 90^\circ$, what is the range of values the angle has in radians?

Find similar ranges for θ when:

- b. $90^\circ \leq \theta \leq 180^\circ$
- c. $180^\circ \leq \theta \leq 270^\circ$
- d. $270^\circ \leq \theta \leq 360^\circ$

78. a) What is the amplitude of $f(x) = 4 \sin(2x)$?

b) What is the amplitude of $f(x) = 3 \cos(2x)$?

c) What is the period of the function in $\sin(4\pi x)$?

d) What is the period of $\cos(2\pi x)$?

79. Recall that for triangle ABC the law of cosines states that $b^2 = a^2 + c^2 - 2ac \cos B$.
 In triangle ABC , $a = 3$, $b = 5$, $c = 6$. Find the cosine of angle B to three decimal places.

80. a) Find the values of $3 \operatorname{Arc} \cos\left(\frac{\sqrt{3}}{2}\right)$, or equivalently $3 \cos^{-1}\left(\frac{\sqrt{3}}{2}\right)$

b. Find the value of $3 \operatorname{Arc} \sin\left(\frac{\sqrt{3}}{2}\right)$, or equivalently $3 \sin^{-1}\left(\frac{\sqrt{3}}{2}\right)$.

c. Find the value of $3 \operatorname{Arc} \tan(1)$, or equivalently $3 \tan^{-1}(1)$

Math Placement Practice Examination Answers

1. 35,263
2. 6,488,716
3. 254,748
4. 512 r. 3
5. 1,2,3,4,6,12
6. a) 200 b) $\frac{9}{125}$
7. 19
8. $11\frac{1}{5}$ or $\frac{56}{5}$

9. $5\frac{17}{21}$ or $\frac{122}{21}$
10. $19\frac{1}{4}$ or $\frac{77}{4}$
11. $\frac{4}{9}$
12. $\frac{1}{12}$ yd.
13. $14\frac{1}{15}$ yd. or $\frac{211}{15}$ yd.
14. True
15. $\frac{7}{32}$
16. 245.1
17. 69.411
18. 128.441
19. 75
20. 2.94
21. 112.5%
22. Brand B
23. $x = 76.5$
24. 3
25. 18
26. $c\left(\frac{1}{4}c\right)$ or $\frac{c^2}{4}$
27. $\frac{r}{8+r}$ or $\frac{r}{r+8}$
28. $11a^2bc - 4ab^2c + 2ab^2c^3$
29. $11x^2y^3 + 2x^2y^2 - 11xy^2 + 1$
30. $a^2 - 9b^4$
31. $17x - 8z$
32. $\frac{27}{4}$
33. $\frac{20}{21}$
34. 2
35. $(x-4)(x-5)$
36. $36\frac{2}{3}$ or $\frac{110}{3}$ Degrees Centigrade
37. $\frac{\sqrt{6}}{3}$

38. $13 + 8x = 11x - 2, x = 5$

$$\frac{3(y-2)}{y+4}$$

39. $\frac{y+4}{x-14}$

40. $\frac{x^2 - 36}{x = 4}$

41. $x = 4$

42. $a = \frac{Ab}{b-A}$

43. $\frac{z^8}{40xy}$

44. $-xy\sqrt{3x}$

45. $4xyz^2\sqrt[3]{x^2y}$

46. $3a^2d^3\sqrt{d}$

47. Straight line increasing from left to right with x-intercept (-2,0) and y-intercept (0,3).

48. $y = \left(\frac{-3}{2}\right)x - 6$

49. A parabola opening downwards with a vertex (2,1); x-intercept (1,0) and (3,0); y-intercept (0,-3) and passing through (4,-3). The axis of symmetry is $x = 2$.

50. Parabola, opening right; vertex (-5,-1) through the points (-1,1), (-1,-3), (4,-4), (4,2) axis of symmetry is $y = -1$.

51. $x = 3$

52. $x = 1, y = 9$

53. A circle with center at (0,0) and radius of 3

54. $\frac{5}{3}$

55. distance is 5

56. $\{x|x \geq 9\} \cup \{x|x \leq 1\}$

57. $\{x|x \leq 9\} \cap \{x|x \geq 1\}$

58. $f(a+3) = \frac{4a+15}{a+5}$

59.
$$\begin{cases} a^2 - b^2 = (a+b)(a-b) \\ a^2 + b^2 = \text{cannot factor} \\ a^3 - b^3 = (a-b)(a^2 + ab + b^2) \\ a^3 + b^3 = (a+b)(a^2 - ab + b^2) \end{cases}$$

60. $A = \pi r^2 + 2\pi rh$

61. $A = 6s^2$

62. $f(x) > -3, f(x) > -3, f(x) = -3$

63. An exponential curve asymptotic to the x-axis, increasing from left to right, going through the points $\left(-2, \frac{1}{9}\right), \left(-1, \frac{1}{3}\right), (0,1), (1,3)$ and $(2,9)$

64. An exponential curve asymptotic to the horizontal axis, decreasing from left to right, going through the points $(-2,25), (0,1)$ and $\left(2, \frac{1}{25}\right)$

65. Curve decreasing from left to right; approaches asymptote of $y = 4$, y-intercept $(0,5)$

$$L = 3W + 4$$

$$P = 2L + 2W = 300$$

$$L = 113.5 \text{ ft.}$$

66. $W = 36.5 \text{ ft.}$

$$A = \frac{1}{2}bh = 266.5$$

$$h = 3b + 2$$

$$h = 41 \text{ in.}$$

67. $b = 13 \text{ in.}$

$$L = 2W$$

$$A = LW = 30$$

$$W = \sqrt{15} \text{ ft.}$$

68. $L = 2\sqrt{15} \text{ ft.}$

69. $\frac{11}{2}$

$$a) \sin \theta = \frac{1}{x}$$

$$b) \cos \theta = \frac{\sqrt{x^2 - 1}}{x}$$

$$c) \tan \theta = \frac{\sqrt{x^2 - 1}}{x^2 - 1}$$

$$d) \csc \theta = x$$

$$e) \sec \theta = \frac{x\sqrt{x^2 - 1}}{x^2 - 1}$$

70. $f) \cot \theta = \sqrt{x^2 - 1}$

71. $\frac{7\pi}{4}, 5.498$

72. $\tan 225^\circ$

73. The curve has an amplitude of 1, a period of π and goes through the points

$$(0,1), \left(\frac{\pi}{4}, 0\right), \left(\frac{\pi}{2}, -1\right), \left(\frac{3\pi}{4}, 0\right) \text{ and } (\pi, 1).$$

74. $\sec \theta$

75. $x = \frac{\pi}{12}, \frac{5\pi}{12}, \frac{3\pi}{4} \left(\frac{9\pi}{12}\right), \frac{13\pi}{12}, \frac{17\pi}{12}, \frac{7\pi}{4} \left(\frac{21\pi}{12}\right)$

76. $\left\{ \begin{array}{l} a) 1 \\ b) \sec^2 \theta \\ c) \csc^2 \theta \\ d) \sin B \\ e) \cos x \\ f) \csc x \\ g) \cot x \\ h) 2 \sin \theta \cos \theta \\ i) \cos^2 \theta - \sin^2 \theta \text{ or } 1 - 2 \sin^2 \theta \text{ or } 2 \cos^2 \theta - 1 \\ j) \frac{2 \tan \theta}{1 - \tan^2 \theta} \end{array} \right.$

a) $\left[0, \frac{\pi}{2}\right]$

b) $\left[\frac{\pi}{2}, \pi\right]$

c) $\left[\pi, \frac{3\pi}{2}\right]$

d) $\left[\frac{3\pi}{2}, 2\pi\right]$

77. a) $|4| = 4$ b) $|3| = 3$ c) $\frac{1}{2}$ d) 1

78. $\cos B = \frac{5}{9}$ or .556

79. a) $\frac{\pi}{2}$ radians or 90° b) π radians or 180° c) $\frac{3\pi}{4}$ radians or 135°

80.