Sample Math Placement Exam Questions: All questions are multiple-choice, one correct answer per question. No credit is lost by guessing. *The test is likely to gauge current skills accurately for those students who review the mathematics they have studied.* Following are sample questions corresponding to the topics described in the syllabus. To save space, some of the sample questions involve several of the topics. However, in Part III of the MPE, unless otherwise noted, each question involves exactly one of the topics. Thus, some of the sample problems might be more difficult than the problems you will encounter.

USE THESE QUESTIONS TO DETERMINE WHICH PART OF THE PLACEMENT EXAM (I-II OR II-III) IS APPROPRIATE FOR YOU! Unless you are completely familiar with the material covered in Part I and Part II of the exam, you should **NOT** take Part III.

Part I

1. $\left(\frac{1}{2}\right)\left(\frac{5}{6}\right)\left(\frac{8}{5}\right) =$
   a) $\frac{5}{12}$ **b)** $\frac{1}{2}$ **c)** $\frac{2}{3}$ **d)** $\frac{4}{3}$ **e)** $\frac{8}{3}$

2. $x^3(2x^{-2} + 4x) =$
   a) $2x + 4x^4$ **b)** $2x^{-6} + 4x^3$ **c)** $2x^5 + 4x^4$
   d) $2x + 4x$ **e)** $2x^{-5} + 4x^4$

3. $x^2 + x - 6$ has a solution
   a) between -5 and -2
   b) between -1 and 0
   c) between 3 and 4.5
   d) between 5 and 7
   e) which is greater than 7

4. The line $2x = 3y - 5$ has slope
   a) 1.5 **b)** -2.5 **c)** $5/3$ **d)** $2/3$ **e)** $5/2$

5. Given the equation of two lines: $x + 2y = 5$ and $2x - 3y = -4$, the point of intersection has (x, y) coordinates:
   a) $(3, 1)$ **b)** $(1, 2)$ **c)** $(2, 1)$ **d)** $(5, 2)$
   e) $(-1, 3)$

Answers: c, a, a, d, b

Part II

1. If $F(x) = x^{1/2}x^{-2/3}$, then $F(2^6) =$
   a) 1 **b)** $1/2$ **c)** 2 **d)** 4 **e)** $1/8$

2. The minimum value of $x^2 - 2x + 3$ is
   a) 1 **b)** 2 **c)** 3 **d)** 4 **e)** 5

3. $\ln(e^3/e^4)$ is equal to
   a) $3/4$ **b)** $\ln 3 - \ln 4$ **c)** $\ln 3/\ln 4$ **d)** $e^{3/4}$
   e) -1

4. The solutions of $|x - 2| = 5$ are
   a) 7 **b)** 3 and 7 **c)** 3 **d)** $\sqrt{21}$ **e)** $\sqrt{29}$

5. If $\cos(\pi/3) = 1/2$, then $\sin 120°$ is
   a) $2\sin(\pi/3)\cos(\pi/3)$ **b)** $3/2$ **c)** $1/2$
   d) $-1/2$ **e)** $-2/3$

Answers: b, b, e, b, a

Part III

1. $\lim_{x\to 2} \frac{4 - x^2}{x^2 - 3x + 2} =$
   a) 4 **b)** 0 **c)** -4 **d)** -1 **e)** ∞

2. The equation of the tangent line to the graph of $y = \frac{x - 1}{x}$ at $x = 1$ is
   a) $y = -(x - 1)$ **b)** $y = (x - 1)$
   c) $y = -1/x^2$ **d)** $y = 1/x^2$
   e) none of the above

3. If x and y are related by the equation $y^2 + \sin(x^2 - 1) = 4$, then the derivative dy/dx at the point $x = -1$, $y = -2$ is
a) -2 **b)** $1/2$ **c)** 2 **d)** $-1/2$
e) none of the above

4. Consider the function $f(x) = \dfrac{x}{x^2 - 1}$. Its graph has the following property:
a) it is increasing for $x > 1$
b) it is decreasing for $x < -1$
c) it has a local minimum at $x = 0$
d) it is symmetric about y-axis
e) none of the above

5. The maximum of $x^3 - 6x^2 + 9x + 1$ on the interval $[0, 2]$ is
a) 1 **b)** 3 **c)** 5 **d)** 7 **e)** 9

6. The derivative of $e^x \ln(x)$ is
a) e^x/x **b)** 1 **c)** $e^x \ln(x)$ **d)** x
e) $e^x \ln(x) + e^x/x$

7. $\dfrac{d}{dx}\displaystyle\int_0^x \sin(t^2)dt$ is
a) $\sin t^2$ **b)** $\sin x^2$ **c)** 0 **d)** $\cos x^2 - 1$
e) $-\cos x^2 + 1$

8. $\displaystyle\int_0^2 \left[\frac{d}{dt}\cos(t^2)\right] dt$ equals
a) $\cos 4$ **b)** $(\cos 4) - 1$ **c)** $(\cos 4) + 1$
d) $-\sin 4$ **e)** $-(\sin 4) + 1$

9. The area of the triangle with vertices $(0, 0)$, $(1, 3)$, and $(2, 2)$ is
a) 1 **b)** 1.5 **c)** 2 **d)** 2.5 **e)** 3

10. $\displaystyle\int \left(3x^2 - 2x\right) dx$ equals
a) $x^3 - x^2 + C$ **b)** $6x - 2 + C$
c) $3x^3 - 2x^2 + C$ **d)** $3x - 2 + C$
e) $x^6 - x^2 + C$

11. The area under the graph of $y = 1/x$ from $x = 1$ to $x = 2$ is
a) $\ln 2$ **b)** $\ln 1$ **c)** $-\frac{1}{4} + 1$ **d)** $\frac{1}{4} - 1$
e) $\frac{1}{2}$

12. $\displaystyle\int x \cos x dx =$
a) $\sin x + C$ **b)** $\left(\frac{x^2}{2}\right)\sin x + C$
c) $x \sin x + C$ **d)** $x \sin x + \cos x + C$
e) none of the above

13. What is the volume of the solid generated by revolving about the x-axis the region under the graph of $3x - x^2$ from $x = 0$ to $x = 3$?
a) $2\pi\displaystyle\int_0^3 \left(3x - x^2\right) dx$
b) $\displaystyle\int_0^3 \left(3x - x^2\right)^2 dx$
c) $\pi\displaystyle\int_0^3 \left(3x - x^2\right)^2 dx$
d) $2\pi\displaystyle\int_0^3 \left(3x - x^2\right)^2 dx$
e) none of the above

14. A force $F(x) = e^x$ moves an object from $x = 1$ to $x = 2$. The work done by this force is
a) e^2 **b)** $e^2 - e$ **c)** $e - e^2$ **d)** $kx^2/2$
e) 0

15. A particle moves so that its position at $t = 0$ is 1 and its velocity at time t is $t \cos t$. Then its position at time $t = \pi/2$ is
a) $\dfrac{\pi}{2}$ **b)** $\dfrac{\pi}{2} + 1$ **c)** 1 **d)** $\dfrac{\pi^2}{2}$
e) none of the above

16. $\displaystyle\int \frac{xdx}{1 + 4x^2} =$
a) $\dfrac{1}{8}\ln(1 + 4x^2) + C$ **b)** $\dfrac{1}{8(1 + 4x^2)^2} + C$
c) $\dfrac{1}{4}\sqrt{(1 + 4x^2)} + C$ **d)** $\dfrac{1}{2}\ln|1 + 4x^2| + C$
e) none of the above

17. For which real values of p does $\int_0^1 \frac{dx}{x^p}$ converge?

a) $\{p : p > 0\}$ **b)** $\{p : p > 1\}$
c) $\{p : p < 0\}$ **d)** $\{p : p < 1\}$
e) all values of p

18. $\lim_{x\to 0} \frac{\sin^2 x}{1-\cos x} =$

a) 1 **b)** 1/2 **c)** $-1/2$ **d)** 2 **e)** 0

19. $\sum_{n=0}^{\infty} \frac{x^n}{3^{2n}} =$

a) $\frac{1}{1-x/9}$ **b)** $\frac{1}{1-x/3}$ **c)** $\frac{1}{1+3x}$
d) ∞ **e)** $1 - x/9$

20. The coefficient of x^4 in the Maclaurin series for $f(x) = e^{-x/2}$ is

a) $-1/24$ **b)** $1/24$ **c)** $-1/96$ **d)** $-1/384$
e) $1/384$

21. The complex number i has one of its square roots equal to

a) $1 + i$ **b)** $1 - i$ **c)** $(1 + i)/2$ **d)** $2(1 + i)$
e) $(1 + i)/\sqrt{2}$

22. The volume $V(t)$ of some gas expands at a rate that is twice $V(t)$, in cubic meters per second. At time $t = 10$ seconds, its volume is known to be $1,000$ cubic meters. What is the volume at $t = 5$ seconds, expressed in cubic meters ($e \sim 2.7$, $e^2 \sim 7.4$)?

a) $V(5)$ is less than 1
b) $V(5)$ is between 1 and 10
c) $V(5)$ is between 10 and 20
d) $V(5)$ is between 20 and 30
e) $V(5)$ is between 30 and 40

23. A function y satisfies $\frac{dy}{dx} = 2y/x$ and $y(1) = 3$. What is $y(2)$?

a) 3 **b)** 6 **c)** 12 **d)** e^2 **e)** e^3

Answers: c, b, d, b, c, e, b, b, c, a, a, d, c, b, a, a, d, d, a, e, e, a, c