

Multiple Choice Answers

Name: _____

Section: _____

Last 4 digits of student ID #: _____

This exam has twelve multiple choice questions (five points each) and five free response questions (eight points each). Additional blank sheets are available if necessary for scratch work. No books or notes may be used. Turn off your cell phones and do not wear ear-plugs during the exam. You may use a calculator, but not one which has symbolic manipulation capabilities.

On the multiple choice problems:

1. You must give your *final answers* in the *multiple choice answer box* on the front page of your exam.
2. Carefully check your answers. No credit will be given for answers other than those indicated on the *multiple choice answer box*.

On the free response problems:

1. Clearly indicate your answer and the reasoning used to arrive at that answer (*unsupported answers may not receive credit*).
2. Give exact answers, rather than decimal approximations to the answer (unless otherwise stated).

Each free response question is followed by space to write your answer. Please write your solutions neatly in the space below the question. You are not expected to write your solution next to the statement of the question.

Question					
1	A	B	C	D	E
2	A	B	C	D	E
3	A	B	C	D	E
4	A	B	C	D	E
5	A	B	C	D	E
6	A	B	C	D	E
7	A	B	C	D	E
8	A	B	C	D	E
9	A	B	C	D	E
10	A	B	C	D	E
11	A	B	C	D	E
12	A	B	C	D	E

Exam Scores

Question	Score	Total
MC		60
13		8
14		8
15		8
16		8
17		8
Webassign Score		100

Record the correct answer to the following problem on the front page of this exam.

- (1) Using complex numbers, solve the quadratic equation exactly and express answer in standard complex form.

$$4x^2 + 6x + 6 = 0.$$

A) $\frac{-3}{4} + \frac{\sqrt{132}}{4}i$

B) The equation has no solution.

C) $\frac{-6 \pm \sqrt{60}}{8}$

D) $\frac{-3}{4} \pm \frac{\sqrt{15}}{4}i$

E) $\frac{-3}{4} \pm \frac{\sqrt{i15}}{4}$

No complex numbers on Spring 2016 exam

- (2) Find the equation of the line passing through $(-1, 2)$ and perpendicular to the line passing through the points $(2, -4)$ and $(-2, 8)$.

A) $y = 3x + 5$

B) $y = \frac{1}{3}x + \frac{7}{3}$

C) $y = \frac{-1}{3}x - \frac{5}{3}$

D) $y = \frac{-1}{3}(x - 2)$

E) $y = 3x - 10$

$$m = \frac{-4 - 8}{2 - (-2)} = \frac{-12}{4} = -3$$

$$m \text{ other line} = \frac{-1}{-3} = \frac{1}{3}$$

$$y - 2 = \frac{1}{3}(x + 1)$$

$$y = \frac{1}{3}x + \frac{1}{3} + 2$$

- (3) Find the average rate of change of the $f(x) = x^2 - x$ as x changes from $x = -2$ to $x = 2$.

A) $\frac{2}{3}$

B) -1

C) 0

D) 1

E) $\frac{3}{2}$

$$\frac{f(x_2) - f(x_1)}{x_2 - x_1}$$

$$\frac{2^2 - (2) - ((-2)^2 - (-2))}{2 - (-2)}$$

$$= \frac{4 - 2 - 4 + 2}{4} = \frac{-4}{4}$$

Record the correct answer to the following problem on the front page of this exam.

(4) Which one of the following is a factor of $p(x) = x^3 - 10x + 3$?

- A) $x - 3$
- B) $x - 1$
- C) $x - 2$
- D) $x + 1$
- E) $x + 3$

$$p(3) = 3^3 - 10(3) + 3 = 27 - 30 + 3 = 0$$

3 a root

→ $(x-3)$ a factor

(5) Determine the end behavior of

as $x \rightarrow -\infty$.

- A) $y \rightarrow \infty$
- B) $y \rightarrow -\infty$
- C) $y \rightarrow 0$
- D) $y \rightarrow 1$
- E) $y \rightarrow \frac{3}{5}$

$$\frac{3x^3 - 2x + 1}{5x^4 - 5x^3 + 1} \quad \begin{matrix} \text{deg } 3 \\ \text{deg } 4 \end{matrix} \rightarrow 0$$

(6) Simplify

- A) $\frac{\sqrt{x}}{y}$
- B) $-2xy$
- C) $\frac{y}{x^2}$
- D) $-2x + y$
- E) $x^{-2} + y$

$$e^{-2\ln(x) + \ln(y)}$$

$$\begin{aligned} & e^{-\ln x^2 + \ln y} \\ & = e^{\ln \frac{y}{x^2}} = \frac{y}{x^2} \end{aligned}$$

Record the correct answer to the following problem on the front page of this exam.

(7) Solve for x exactly.

$$\ln(x) + \ln(x+1) = \ln(6)$$

A) $\frac{5}{2}$

B) $\frac{1}{2}$

C) 2 and -3.

D) The equation has no solution.

E) 2 only.

$$\ln(x(x+1)) = \ln(6)$$

$$x^2 + x = 6$$

$$x^2 + x - 6 = 0$$

$$\begin{array}{|l} (x+3)(x-2) \\ x = -3 \quad | \quad x = 2 \\ \downarrow \\ \text{undefined} \end{array}$$

(8) Solve the absolute value inequality.

$$|2x + 4| \leq 5$$

A) The inequality has no solution.

B) $[-18, 4]$

C) $(-\infty, \frac{1}{2}] \cup [\frac{9}{2}, \infty)$

D) $[\frac{-9}{2}, \frac{1}{2}]$

E) $(-\infty, \frac{-9}{2}] \cup [\frac{1}{2}, \infty)$

$$-5 \leq 2x + 4 \leq 5$$

$$-9 \leq 2x \leq 1$$

$$-\frac{9}{2} \leq x \leq \frac{1}{2}$$

(9) Find the solution to

$$\frac{x+1}{x-2} \geq 0.$$

A) $[2, \infty)$

B) $(-\infty, -1] \cup (2, \infty)$

C) $(-\infty, -2] \cup [-1, \infty)$

D) $[-1, 2)$

E) $(-\infty, -1] \cup [2, \infty)$

$$\begin{array}{c} 0 \qquad \qquad \qquad u \\ \begin{array}{ccccccc} - & - & | & + & + & + & + \\ \hline & & -1 & & & & 2 \end{array} \\ x+1 \end{array}$$

$$\begin{array}{c} \begin{array}{ccccccc} - & - & | & - & - & | & + \\ \hline & & -1 & & & & 2 \end{array} \\ x-2 \end{array}$$

$$\begin{array}{c} \begin{array}{ccccccc} + & & & - & & & + \\ \hline & & -1 & & & & 2 \end{array} \\ \frac{x+1}{x-2} \end{array}$$

$$(-\infty, -1] \cup (2, \infty)$$

Record the correct answer to the following problem on the front page of this exam.

(10) Find $\tan\left(-\frac{\pi}{3}\right)$ exactly.

A) $\sqrt{3}$

B) $\frac{-\sqrt{3}}{3}$

C) $\sqrt{2}$

D) $-\sqrt{3}$

E) -1

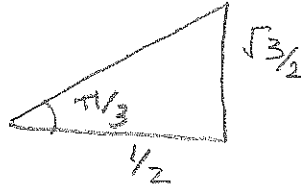
$\tan\left(-\frac{\pi}{3}\right)$

↑ QIV

$\tan < 0$



$\frac{\sqrt{3}/2}{1/2} = \sqrt{3}$



(11) Determine which one of the following statements is false.

T A) $\sin(x) = \cos\left(x - \frac{\pi}{2}\right)$ for all values of x .

T B) $\sin(x) > 0$ for $0 < x < \pi$.

T C) $\cos(x) = \cos(x - 8\pi)$ for all values of x .

T D) $\sec\left(\frac{\pi}{2}\right)$ is undefined.

E) $\cot\left(\frac{21\pi}{4}\right) = -1$

(12) Find $\cos(t)$ if $\sin(t) = -\frac{\sqrt{3}}{5}$ and t is in the fourth quadrant.

A) $\frac{\sqrt{22}}{5}$

B) $\frac{\sqrt{4}}{5}$

C) $\frac{\sqrt{5}}{22}$

D) $-\frac{\sqrt{22}}{5}$

E) $-\frac{\sqrt{2}}{3}$

$\cos(x) > 0$



$\cos = \pm \sqrt{1 - \left(-\frac{\sqrt{3}}{5}\right)^2}$

$= \pm \sqrt{1 - \frac{3}{25}} = \pm \sqrt{\frac{22}{25}}$

$= + \frac{\sqrt{22}}{5}$

Free Response Questions: Show your work!

(13) Given

$$f(x) = 5 \sin\left(3x - \frac{\pi}{2}\right)$$

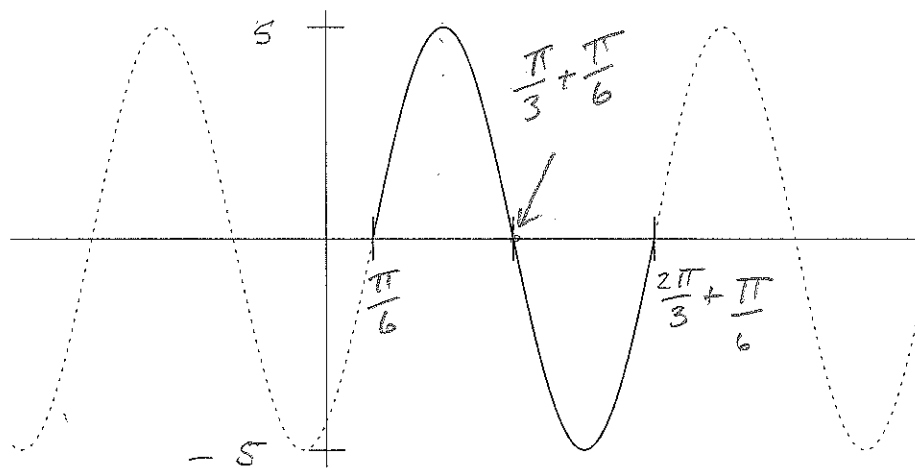
1. Find the amplitude, period, and phase shift for $f(x)$.

$$f(x) = 5 \sin\left(3\left(x - \frac{\pi}{6}\right)\right)$$

\uparrow stretch \downarrow shrink \downarrow shift right $\frac{\pi}{6}$
 5 3

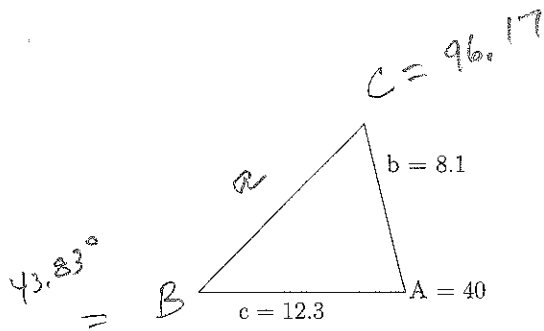
amp = 5, period = $\frac{2\pi}{3}$, shift = $\frac{\pi}{6}$

2. Label the five tick marks indicated on the x - and y - axes on the graph below.



Free Response Questions: Show your work!

- (14) Solve the triangle ABC shown below. Round answers to two decimal places. The angle is in degrees so make sure your calculator is in degree mode! (The triangle may not be to scale.)



$$a = \sqrt{b^2 + c^2 - 2bc \cos(A)}$$
$$= \sqrt{8.1^2 + 12.3^2 - 2(8.1)(12.3) \cos(40)} = 8.0161078$$

$$\cos(C) = \frac{c^2 - a^2 - b^2}{-2ab} = -0.1075$$

$$C = \cos^{-1}(-0.1075) = 96.17^\circ$$

$$B = 180 - 40 - 96.17 = 43.83^\circ$$

Free Response Questions: Show your work!

- (15) Find the time it takes for an investment of \$3000 to grow to \$4,000 if it is put into an account with a 6.1% interest rate compounded continuously. Solve algebraically and show all work. Your answer should be exact.

$$4000 = 3000 e^{.061t}$$

$$\frac{4}{3} = e^{.061t}$$

$$\ln\left(\frac{4}{3}\right) = .061t$$

$$\boxed{\frac{\ln\left(\frac{4}{3}\right)}{.061} = t \approx}$$

4.7 years

Free Response Questions: Show your work!

(16) Find the center and the radius of the circle given by

$$x^2 - 6x - 5 + y^2 + 2y - 7 = 0.$$

$$x^2 - 6x + 9 + y^2 + 2y + 1 = 5 + 7 + 9 + 1$$

$\left(-\frac{6}{2}\right)^2 = (-3)^2 = 9$ $\left(\frac{2}{2}\right)^2 = 1$

$$(x - 3)^2 + (y + 1)^2 = 22$$

$$\text{center} = (3, -1)$$

$$\text{radius} = \sqrt{22}$$

Free Response Questions: Show your work!

(17) (a) Find the difference quotient $\frac{f(x+h) - f(x)}{h}$ for

$$f(x) = 3x^2 - 2x + 3.$$

$$\frac{3(x+h)^2 - 2(x+h) + 3 - (3x^2 - 2x + 3)}{h}$$

$$= \frac{3(x^2 + 2xh + h^2) - 2x - 2h + 3 - 3x^2 + 2x - 3}{h}$$

$$\frac{3x^2 + 6xh + 3h^2 - 2x - 2h + 3 - 3x^2}{h} = \frac{h(6x + 3h - 2)}{h}$$

$$= 6x + 3h - 2$$

(b) Use your answer from part (a) to find the average rate of change of $f(x)$ as x changes from $x = -2$ to $x = 1$. Indicate the values of h and x .

$$h = 1 - (-2) = 4$$

$$x = -2$$

$$6(-2) + 3(4) - 2$$

$$= \boxed{-2}$$

Free Response Questions: Show your work!

Some Useful Formulas

$$B(t) = P(1 + r)^t$$

$$B(t) = P \left(1 + \frac{r}{n} \right)^{nt}$$

$$P(t) = P_0 e^{rt}$$

$$Q(t) = Q_0 e^{-rt}$$

$$a^2 = b^2 + c^2 - 2bc \cos(A)$$

$$b^2 = a^2 + c^2 - 2ac \cos(B)$$

$$c^2 = a^2 + b^2 - 2ab \cos(C)$$

$$\frac{\sin(A)}{a} = \frac{\sin(B)}{b} = \frac{\sin(C)}{c}$$