

22/25



**BIRZEIT UNIVERSITY**

Mathematics Department  
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**FIRST EXAM – MATH 141**

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Section: 4

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**Answer sheet for the multiple choice question:**

Page 1	
1	d
2	a
3	b
4	b
5	c

Page 2	
6	b
7	d
8	c
9	b
10	b

Page 3	
11	d
12	a
13	b
14	d
15	c

Page 4	
16	d
17	d
18	a
19	b
20	b

$$x^2 + y^2 = r^2$$

$$x^2 + 9 = 25$$

$$\frac{y}{r}$$

$$x^2 = 16$$

$$x = \pm 4$$

$$x^2 + y^2 = r^2$$

$$3^2 + y^2 = 5^2$$

Step 1

Question 1. (20%). Circle the most correct answer:

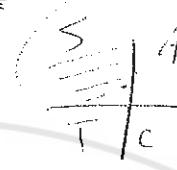
1. If  $\sin x = \frac{3}{5}$ ,  $x \in [\frac{\pi}{2}, \pi]$ , then  $\cos x =$

- (a)  $\frac{3}{5}$
- (b)  $\frac{4}{5}$
- (c)  $\frac{-3}{5}$
- (d)  $\frac{-4}{5}$

~~3/5~~

$$\sin x = \frac{y}{r}$$

$$9 + x^2 = 25$$



$$\frac{-4}{5}$$

$$x = \pm 4$$

2.  $\lim_{x \rightarrow 7} \sqrt{11-x} = 2$ , given  $\epsilon = 1$  find the largest  $\delta$  such that  $0 < |x-7| < \delta$ , then

$$|\sqrt{11-x} - 2| < \epsilon$$

- (a)  $\delta = 3$
- (b)  $\delta = 5$
- (c)  $\delta = 4$
- (d)  $\delta = 2$

$$-1 < \sqrt{11-x} - 2 < 1$$

$$+2 \quad +2 \quad +2$$

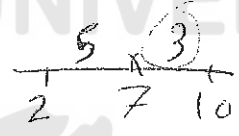
$$1 < \sqrt{11-x} < 3$$

$$\frac{x^2(1-0)}{x(1+0)} = \infty$$

$$1 < 11-x < 9$$

3.  $\lim_{x \rightarrow \infty} \frac{x^2 - 7x}{x + 1} =$

- (a)  $-\infty$
- (b)  $\infty$
- (c) 1
- (d) -7



$$-1 < -x < -2$$

$$2 < x < 10$$

\* 4. Consider the function  $f(x) = \frac{x^2 - 3x - 4}{16 - x^2}$ , then the vertical asymptote/s is/are

- (a)  $x = 4$
- (b)  $x = -4$
- (c)  $x = 4, x = -4$
- (d) None of the above

$$x^2 = -16$$

$$x = \pm 4$$

5. The domain of the function  $f(x) = \frac{\sqrt{2-x}}{x+1}$  is

- (a)  $[-2, 1) \cup (1, \infty)$
- (b)  $(-\infty, 2]$
- (c)  $(-\infty, -1) \cup (-1, 2]$
- (d)  $(-\infty, -1) \cup (-1, 2)$

$$(-\infty, -1)$$

$$\frac{(x-4)(x+1)}{(x-4)(x+4)}$$

$$\frac{(x-4)(x+1)}{-(x-4)(x+4)} = \frac{x+1}{-(x+4)}$$

$$\frac{-(x+1)}{(4+x)}$$

$$-6$$

$$+4$$

-4

6.  $\lim_{x \rightarrow \infty} \sqrt{\frac{8x^2 - 3}{2x^2 + x}} =$

- (a)  $-\infty$
- (b) 2
- (c)  $\infty$
- (d) 4

$$= \sqrt{\frac{x^2(8-0)}{x^2(2+0)}} = \sqrt{\frac{8}{2}} = 2$$

$$= \frac{x^2(8 - \frac{3}{x^2})}{x^2(2 + \frac{1}{x})} = \frac{8 - \frac{3}{x^2}}{2 + \frac{1}{x}} \xrightarrow{x \rightarrow \infty} \frac{8}{2} = 4$$

\* 7. The graphs of the functions  $f(x) = x^2 - 5x + 2$  and  $g(x) = -2x^3 + 4x + 3$  intersect over the interval

- (a)  $(-2, -1)$
- (b)  $(0, 1)$
- (c)  $(1, 2)$
- (d)  $(2, 3)$

$$x^2 - 5x + 2 = -2x^3 + 4x + 3$$

$$2x^3 - 5x^2 - 4x - 1 = 0$$

8. Find value/s of  $b$  for which the function  $f(x)$  is continuous for all values of  $x$

$$f(x) = \begin{cases} \frac{\sin(3x)}{4x}, & x \neq 0; \\ b - 4x, & x = 0. \end{cases}$$

- (a)  $\frac{1}{2}$
- (b)  $-\frac{1}{2}$
- (c)  $\frac{3}{4}$
- (d)  $\frac{3}{2}$

$$\lim_{x \rightarrow 0} \frac{\sin 3x}{4x} = \frac{1}{4} \cdot \frac{\sin 3x}{3x} \cdot 3x \cdot \frac{1}{4x} = \frac{1}{4} \cdot 1 \cdot \frac{3}{4} = \frac{3}{16}$$

$$\frac{3}{4} = b$$

\* 9. The range of  $f(x) = \frac{1}{x-2} + 3$  is

- (a)  $(-\infty, 3) \cup (3, \infty)$
- (b)  $(0, \infty)$
- (c)  $(-\infty, \infty)$
- (d)  $(-\infty, \infty) - 2$

$$-1 + 3 = 2 \neq 3$$

10.  $\lim_{x \rightarrow 0} \frac{\cos^2 x - 1}{x \sin(2x)} =$

- (a) 0
- (b)  $-\frac{1}{2}$
- (c)  $\frac{1}{2}$
- (d) DNE

$$\frac{1 + \cos 2x - 1}{x \sin(2x)}$$

$$\frac{\cos x \times \cos x - 1}{x \times 2x} = \frac{\cos^2 x - 1}{2x^2} = \frac{-\sin^2 x}{2x^2} \xrightarrow{x \rightarrow 0} -\frac{1}{2}$$

$$-\frac{1}{2}$$

$$\frac{(x+\cancel{3})(x+\cancel{4})}{x(x+3)(x-3)}$$

$$\frac{(x)(x-3)}{x(x+3)(x-3)}$$

11. The function  $f(x) = \frac{x^2 + 7x + 12}{x^3 - 9x}$  has a removable discontinuity at

- (a)  $x = -3$  and  $x = 3$
- (b)  $x = 3$
- (c)  $x = 0$
- (d)  $x = -3$

$$\frac{x^2 - 9}{x(x+3)(x-3)}$$

12. The period of  $y = \cos\left(\frac{\pi x}{2} - \frac{2}{\pi}\right)$  is

- (a) 4
- (b)  $\frac{2}{\pi}$
- (c)  $2\pi$
- (d)  $\frac{\pi}{2}$

$$\frac{T}{2} = \frac{2T}{3}$$

$$3T = 4T$$

$$T = 4$$

13.  $\lim_{x \rightarrow -\infty} \frac{\sin(x)}{x}$

- (a) -1
- (b) 0
- (c) 1
- (d) DNE

14.  $\lim_{x \rightarrow 0^+} \frac{\sqrt{x^2 + 4x + 1} - 1}{x} =$

- (a) 4
- (b) -2
- (c) -4
- (d) 2

$$\Rightarrow \frac{\sqrt{x^2 + 4x + 1} - 1}{x} \cdot \frac{\sqrt{x^2 + 4x + 1} + 1}{\sqrt{x^2 + 4x + 1} + 1} = \frac{x^2 + 4x + 1 - 1}{x(\sqrt{x^2 + 4x + 1} + 1)}$$

$$\frac{4}{\sqrt{1} + 1} = \frac{4}{2} = 2$$

15. The horizontal asymptote of  $f(x) = \frac{1-x^2}{x^2+1}$

- (a)  $y = 0$
- (b)  $y = 1$
- (c)  $y = -1$
- (d) None of the above.

$$\lim_{x \rightarrow \infty} \frac{x^2(0-1)}{x^2(1+0)} = -1$$

$$\lim_{x \rightarrow -\infty} = -1$$

$$\frac{x(x+4)}{x^2 + 4x + 1} \cdot \frac{x(\sqrt{x^2 + 4x + 1})}{x(\sqrt{x^2 + 4x + 1})} = \frac{4}{\sqrt{1} + 1} = \frac{4}{2} = 2$$

16. If the graph of the circle  $x^2 + y^2 = 25$  is shifted upward by 3 units, and leftward by 4 units, then the new formula of the circle is

- (a)  $(x + 4)^2 + (y + 3)^2 = 25$
- (b)  $(x - 4)^2 + (y + 3)^2 = 25$
- (c)  $(x - 4)^2 + (y - 3)^2 = 25$
- (d)  $(x + 4)^2 + (y - 3)^2 = 25$

17. The function  $f(x) = |x| + x \cos x$  is

- (a) odd function.
- (b) even function.
- (c) both even and odd function.
- (d) neither even nor odd function.

$$f(-x) = |-x| + (-x) \cos(-x) = |x| - x \cos x \neq f(x)$$

18. Let  $g(x) = \sqrt{x}$  and  $(g \circ f)(x) = |x|$ , then  $f(x) =$

- (a)  $f(x) = -x^2$
- (b)  $f(x) = \frac{1}{x^2}$
- (c)  $f(x) = x^2$
- (d)  $f(x) = \frac{-1}{x^2}$

$$g(f(x)) = \sqrt{f(x)} = |x|$$

$$f(x) = x^2$$

19.  $\lim_{x \rightarrow -1^+} \frac{|x+1|}{2x+2} =$

- (a)  $\frac{-1}{2}$
- (b)  $\frac{1}{2}$
- (c) 0
- (d) DNE

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

$$\frac{|x+1|}{2x+2} = \frac{x+1}{2(x+1)} = \frac{1}{2}$$

20.  $\lim_{x \rightarrow 0} \frac{2 \cos x}{\sqrt{x+1} - 2} =$

- (a) 0
- (b) -2
- (c)  $\frac{1}{2}$
- (d) DNE

$$\frac{2 \times 1}{\sqrt{1} - 2} = \frac{2}{-1} = -2$$

$$\frac{1}{1+1} = \frac{1}{2}$$

$$\frac{(2 \cos x)(\sqrt{x+1} + 2)}{(x+1) - 4} = \frac{2 \cos x (\sqrt{x+1} + 2)}{x-3}$$

Question 2. (5%) Let  $f(x) = \frac{x}{4 - x^2}$  Sketch the graph of  $f(x)$  where;

Domain of  $f(x)$  is  $(-\infty, \infty) - \{-2, 2\}$

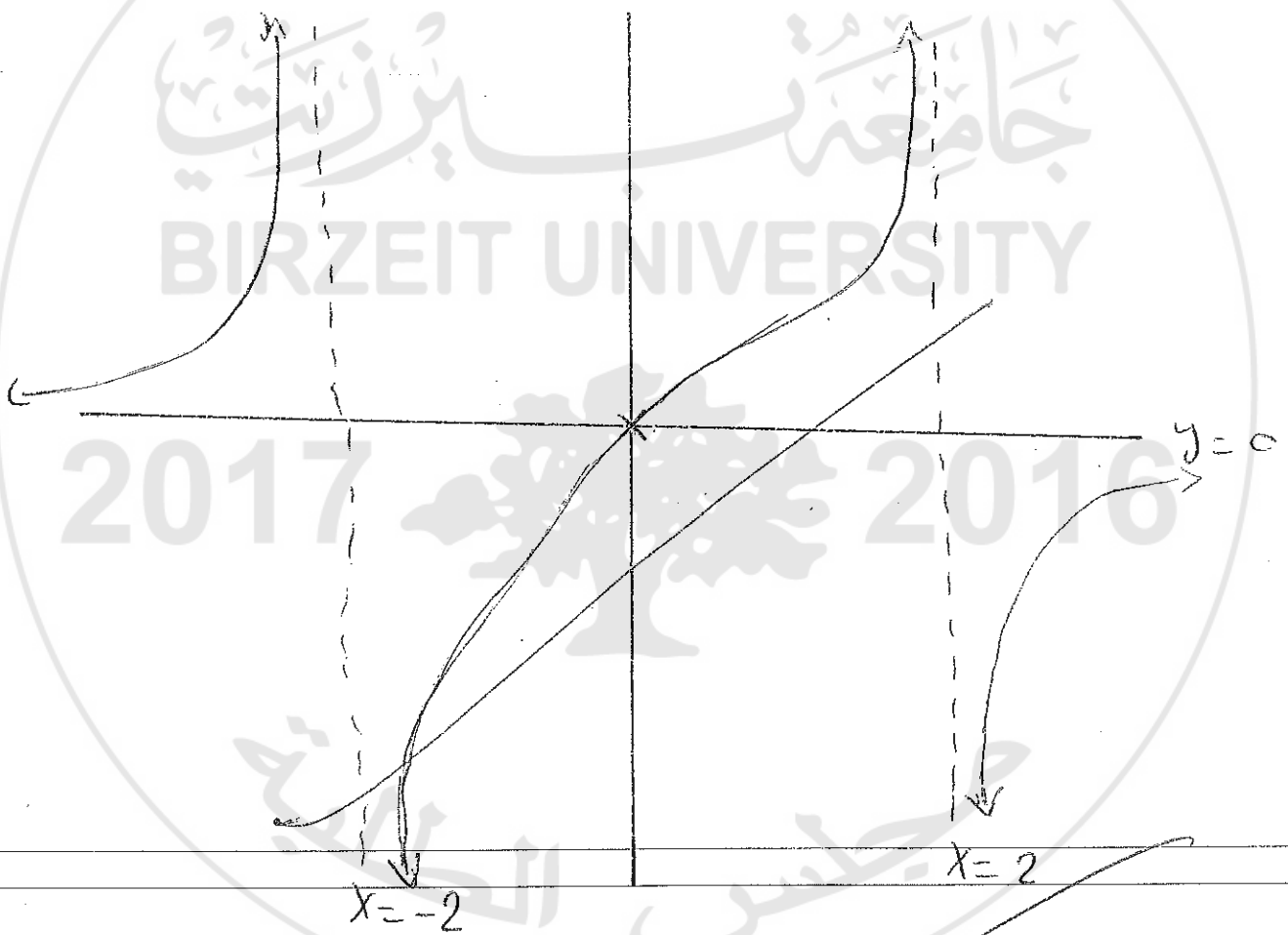
$f(0) = 0$

$\lim_{x \rightarrow \infty} f(x) = 0, \lim_{x \rightarrow -\infty} f(x) = 0$

$\lim_{x \rightarrow 2^+} f(x) = -\infty, \lim_{x \rightarrow 2^-} f(x) = \infty$

$\lim_{x \rightarrow -2^+} f(x) = -\infty$  and  $\lim_{x \rightarrow -2^-} f(x) = \infty$ .

Handwritten notes in boxes:  
 $y=0$  H.A.Sy  
 $x=-2$  V.A.Sy  
 $x=2$  V.A.Sy



Handwritten signature or mark.