

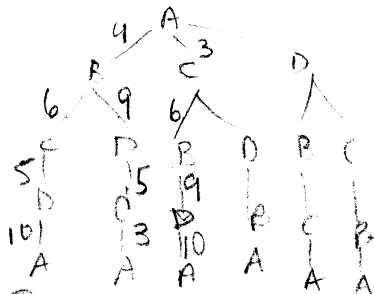
ICM Final Exam Mixed Review Solutions

1. a. vertex | degree

A	3
B	1
C	4
D	2
E	2

- b. 6 edges
- c. simple
- d. yes
- e. Euler path BCDAE
- f. Hamiltonian path BCDAE

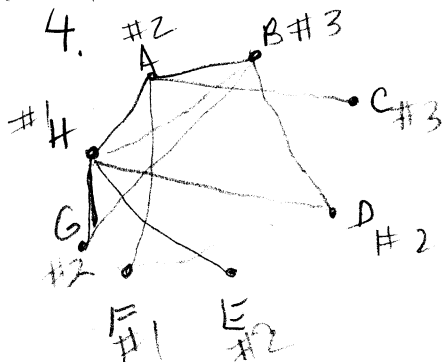
2. $ACDRA = 26$
 3151919



- ABCD A = 30
- ABDCA = 26
- ACBDA = 28
- ACDBA = 26
- ADBCA = 28
- ADCBA = 30

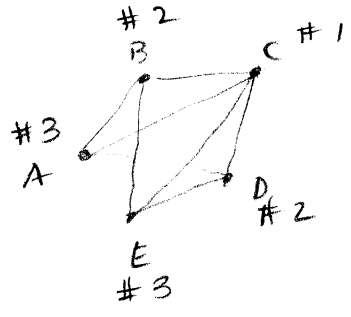
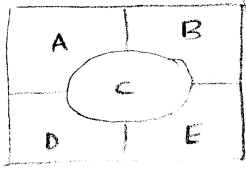
3. a) Lou
 b) Lou, Hal, Ken, Max, Sue
 c) Ed, Joe, Ted
 d) Ed
 e) Max
 f) Ed, Ken
 g) 3
 h) 2
 i) Ken, Hal, Lou
 j) Sue, Ted
 k) Ed, Joe, Hal, Ken, Lou, Max, Sue, Ted
 l) Lou, Hal, Ed, Ken, Joe, Max, Sue, Ted
 m) Ed, Joe, Ken, Hal, Ted, Sue, Max, Lou

omit for fall 2017



3

5.



3

6.

	<u>N</u>	<u>T</u>	<u>E</u>
total bid	210000	240000	243000
FS	70000	80000	81000
item/value	none 0	painting 40000	house 210000
item FS	-70000	-40000	129000
	129000		
	-110000		
	19000 surplus $\div 3 = 6333.33$		

N: receives \$76333.33
 T: receives painting & \$46333.33
 G: receives house; pays \$122666.67

7.

$SD = \frac{825}{25} = 33$

dept		<u>SQ</u>	<u>LQ</u>	<u>UQ</u>	<u>Ham.</u>	<u>Jeff</u>
IC	311	9.424	9	10	9	10
Co-rd	272	8.242	8	9	8	8
Mat	188	5.697	5	6	6	6
Ped	54	1.636	1	2	2	1
	<u>825</u>	<u>25</u>	<u>23</u>	<u>27</u>	<u>25</u>	<u>25</u>

md=31

<u>Web</u>	<u>H-H</u>
9	9
0	8
6	6
2	2
<u>25</u>	<u>25</u>

$SQ < GM \Rightarrow LQ$
 $SQ > GM \Rightarrow UQ$
 6 Mean
 $\sqrt{90} = 9.487$
 $\sqrt{72} = 8.485$
 $\sqrt{30} = 5.477$
 $\sqrt{2} = 1.414$

8. a)
$$\begin{array}{cccc} \underline{I} & \underline{C} & \underline{F} & \underline{M} \\ 22 & 20 & 12 & 19 \end{array} \quad \boxed{\text{Italian}}$$

b) total votes = 73 $\boxed{\text{no}}$ -- need 37 votes

c)
$$\begin{array}{cc} \underline{I} & \underline{C} \\ 22 & 20 \\ +10 & +12 \\ \hline 32 & 32 \\ & +9 \\ & \hline & 41 \end{array} \quad \boxed{\text{Chinese}}$$

d)
$$\begin{array}{cccc} \underline{I} & \underline{C} & \underline{F} & \underline{M} \\ 22 & 20 & 12 & 19 \\ -2 & 20 & & 31 \\ \hline 20 & & & 51 \end{array} \quad \boxed{\text{Mexican}}$$

e) I: $4(22) + 3(0) + 2(10) + 1(41) = 149$

C: $4(20) + 3(9) + 2(34) + 1(10) = 185$

F: $4(12) + 3(30) + 2(9) + 1(22) = 178$

M: $4(19) + 3(34) + 2(20) + 1(0) = 218$

$\boxed{\text{Mexican}}$

f)
$$\begin{array}{cccc} \underline{I} & \underline{C} & \underline{F} & \underline{M} \\ 22 & 20 & 20 & 22 \\ & 9 & 12 & 12 \\ & & 10 & 9 \\ & & & 10 \\ \hline 22 & 29 & 42 & 53 \end{array}$$

$\boxed{\text{Mexican}}$

9. a) 9
 b) 20
 c) 28

$$\begin{array}{ccccc} A & B & C & D & E \\ 3 & 3 & 2 & 2 & 1 \end{array} \quad \text{quota} = 8$$

10. a) <u>winning coalitions</u>	<u>wt</u>	<u>critical</u>
ABC	8	A, B, C
ABD	8	A, B, D
ABCD	10	A, B
ABCE	9	A, B, C
ABDE	9	A, B, D
ACDE	8	A, C, D, E
BCDE	8	B, C, D, E
ABCDE	11	none

b)

$$\begin{array}{l} A \quad \frac{6}{22} = \frac{3}{11} \\ B \quad \frac{6}{22} = \frac{3}{11} \\ C \quad \frac{4}{22} = \frac{2}{11} \\ D \quad \frac{4}{22} = \frac{2}{11} \\ E \quad \frac{2}{22} = \frac{1}{11} \end{array}$$

11. $6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = \boxed{720}$

12. $\underline{26} \quad \underline{26} \quad \underline{10} \quad \underline{10} = \boxed{67,600}$

13. $20 C_7 = \boxed{77520}$

14. a) $\frac{2}{10} = \frac{1}{5}$
 b) $\frac{4}{10} = \frac{2}{5}$
 c) $\frac{2}{10} = \frac{1}{5}$
 d) $\frac{1}{10}$
 e) $\frac{1}{10}$
 f) $\frac{0}{10} = 0$
 g) $\frac{3}{10}$

15. $\frac{4}{6} = \frac{2}{3}$

$$16. \frac{3}{12} \cdot \frac{9}{15} = \frac{27}{180} = \boxed{\frac{3}{20}}$$

$$17. P(W \in B) = \frac{2}{3} \cdot \frac{1}{3} = \boxed{\frac{2}{9}}$$

$$18. a) \frac{2}{10} \cdot \frac{3}{9} = \frac{6}{90} = \boxed{\frac{1}{15}} \quad b) \frac{5}{10} \cdot \frac{4}{9} = \frac{20}{90} = \boxed{\frac{2}{9}}$$

$$19. P(\text{no} | \text{male}) = \frac{P(\text{no} \cap \text{male})}{P(\text{male})} = \frac{\frac{25}{100}}{\frac{40}{100}} = \frac{25}{40} = \boxed{\frac{5}{8}}$$

$$20. a) P(x=4) = .096 \quad \text{geompdf}(1/6, 4)$$

$$b) P(x \leq 4) = .518 \quad \text{geomcdf}(1/6, 4)$$

$$c) P(x \leq 5) = .599 \quad \text{geomcdf}(1/6, 5)$$

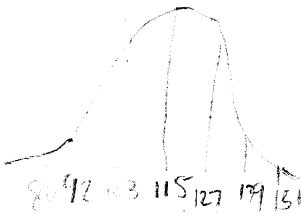
$$d) \frac{1}{\frac{1}{6}} = 6$$

$$21. a) P(x=2) = .264 \quad \text{binompdf}(5, .25, 2)$$

$$b) P(x \leq 3) = .984 \quad \text{binomcdf}(5, .25, 3)$$

$$c) P(x \geq 4) = 1 - P(x < 4) = .016 \quad 1 - \text{binomcdf}(5, .25, 3)$$

22. a.



$$b. \text{normcdf}(-999999, 130, 115, 12) = .106$$

$$c. \text{normcdf}(130, 999999, 115, 12) = .106$$

$$d. \text{normcdf}(110, 130, 115, 12) = .556$$

$$23. z\text{-score} = \frac{\text{item} - \text{mean}}{\text{SD}}$$

$$\text{Ted: } \frac{325 - 27}{137} = 1.486$$

$$\text{Frank: } \frac{317 - 28}{133} = 1.121$$

~~Ted~~ higher
s.dev
above
mean

24. a) \$161.67
 b) \$160
 c) \$140
 d) \$130

90 140 140 180 200 220

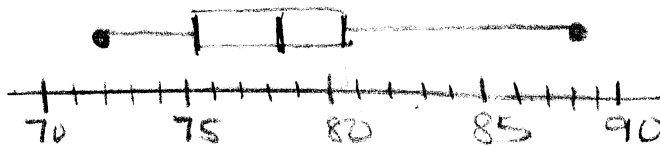
25.

test scores	freq
91-100	9
81-90	6
71-80	3
61-70	0
51-60	2

26. sample s.d. = 10.737
 (s_x)

27. pop. s.d. = 1.625
 (σ_x)

*omit 2017 28. min = 72 Q1 = 75.5 med = 78.5 Q3 = 80.5 max = 88



$IQR = 80.5 - 75.5 = 5$

$1.5 * 5 = 7.5$

$Q1 - 7.5 = 75.5 - 7.5 = 68$

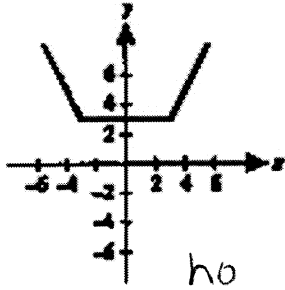
$Q3 + 7.5 = 80.5 + 7.5 = 88$ - no outliers

29. a) 56 b) 99 c) 40-99

30. a) 16
 b) 200-209

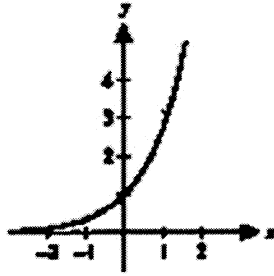
31. Determine if each function is one-to-one.

A.



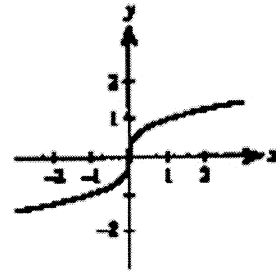
no

B.



yes

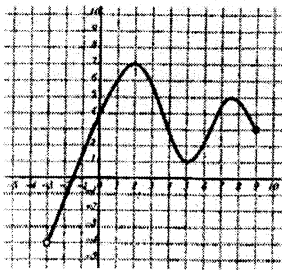
C.



yes

32. Give the domain and range of each function.

A.



B. $f(x) = \sqrt{x-3} + 2$

D: $[3, \infty)$

R: $[2, \infty)$

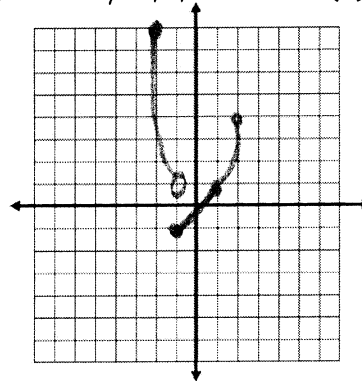
D: $(-3, 9]$

R: $(-4, 7]$

33. Describe the transformations on the parent function $y = |x|$ to obtain $f(x) = -|x + 2| - 7$.

34. Graph:

$$y = \begin{cases} -x^3 & \text{for } -2 \leq x < -1 \\ x & \text{for } -1 \leq x \leq 1 \\ x^2 & \text{for } 1 \leq x \leq 2 \end{cases}$$



- shift left 2
- reflect over x-axis
- down 7

35. Find the inverse: $f(x) = (x - 2)^2 + 5, x < 2$

36. Describe the end behavior of the function $f(x) = -x^5 + 4x^3 + 1$.

37. Give the degree, find the roots, and sketch a graph: $f(x) = x^3 + 4x^2 + 5x + 2$

38. Identify any asymptotes: $f(x) = \frac{2x^2 + 5x + 3}{x^2 - 9} = \frac{(2x+3)(x+1)}{(x+3)(x-3)}$ h.a. $y = 2$ v.a. $x = -3, x = 3$

39. A toy rocket is launched vertically upward from ground level with an initial velocity of 128 feet per second. Its height after t seconds is given by $h(t) = -16t^2 + 128t$.

- a. How long does it take for the rocket to return to the ground?
- b. After how many seconds will the rocket be 112 feet above the ground?
- c. How long will it take for the rocket to reach its maximum height?
- d. What is the rocket's maximum height?

see other pg

see other pg

35. $x = (y-2)^2 + 5$
 $x-5 = (y-2)^2$
 $y-2 = \pm \sqrt{x-5}$
 $y = 2 \pm \sqrt{x-5}$

$$f^{-1}(x) = 2 - \sqrt{x-5}$$

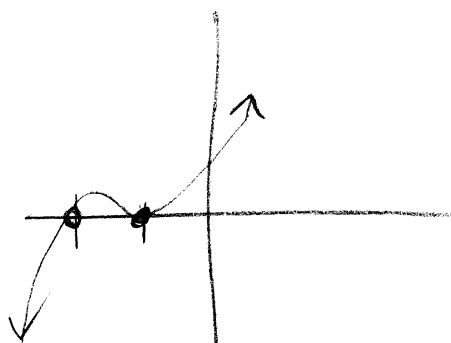
$x > 5$

36. $\lim_{x \rightarrow -\infty} f(x) = \infty$ $\lim_{x \rightarrow \infty} f(x) = -\infty$

37. degree = 3
rational root thm

p: $\pm 1, \pm 2$
q: ± 1
p/q: $\pm 1, \pm 2$

-1 | 1 4 5 2
 | -1 -3 -2
---|---
 | 1 3 2 0
 $x^2 + 3x + 2 = 0$
 $(x+2)(x+1) = 0$
 $x = -2, -1$



roots: -1 (mult. 2)
 -2

39. a. $-16t^2 + 128t = 0$
 $-16t(t-8) = 0$
 $t = 0, 8$ in 8sec

c. vertex
 $x = \frac{-128}{2(-16)} = \frac{-128}{-32} = 4$
4sec

b. $112 = -16t^2 + 128t$
 $0 = -16t^2 + 128t - 112$
 $0 = -16(t^2 - 8t + 7)$
 $0 = -16(t-7)(t-1)$
 $t = 7, t = 1$

d. $y = -16(4)^2 + 128(4)$
 $-256 + 512$
256 ft

after 1sec

40. $(3)^{2(x-1)} = 3^1$
 $2x - 2 = 1$
 $x = 3/2$

41. $y = Aert = 2000(e)^{0.045(7)}$ $\$2740.52$

42. $9,1500$
 40

40 $\overline{)1500}$
 37.5
 120
 300
 280
 200

38 people

b. $R(2) = 201$

c. $1000 = \frac{1500}{1 + 39e^{-.9t}}$ 5 days

d. 1500

43.

$3^2 + (-7)^2 = h^2$
 $58 = h^2$
 $h = \sqrt{58}$

$\sin \theta = \frac{-7}{\sqrt{58}}$ $\cos \theta = \frac{3}{\sqrt{58}}$ $\tan \theta = \frac{-7}{3}$

$\csc \theta = -\frac{\sqrt{58}}{7}$ $\sec \theta = \frac{\sqrt{58}}{3}$ $\cot \theta = -\frac{3}{7}$

see other pg

40. Solve: $9^{x-1} = 3$
41. If interest is compounded continuously at 4.5% for 7 years, how much will a \$2000 investment be worth at the end of 7 years?
42. A school has 1500 students. A rumor begins to spread, modeled by the logistic equation $R(t) = \frac{1500}{1 + 39e^{-0.9t}}$ where $t = 0$ is the day the rumor begins to spread & $R(t)$ represents the number of students who have heard the rumor by the end of t days.
- How many students initially heard the rumor?
 - How many students have heard the rumor by the end of day 2?
 - How long does it take for 1000 students to hear the rumor?
 - How many students can be predicted to eventually hear the rumor?
43. If $(3, -7)$ is a point on the terminal side of an angle θ , find the exact value of each of the six trigonometric functions.

44. In what quadrant is $\tan \theta > 0$ and $\csc \theta < 0$? III

45. Find the reference angle: -125°

46. Find a positive and negative coterminal angle for the angle: 142° 502°, -218° *<answer vary>*

47. Find the following values:

$\cos 120^\circ$ $-\frac{1}{2}$ $\sin\left(-\frac{\pi}{4}\right)$ $-\frac{\sqrt{2}}{2}$ $\tan \frac{\pi}{3}$ $\sqrt{3}$

$\csc 450^\circ$ 1 $\sec(-180^\circ)$ -1 $\cot \frac{5\pi}{4}$ 1

48. Convert 170° to radians. $170^\circ \cdot \frac{\pi}{180} = \frac{17\pi}{18}$

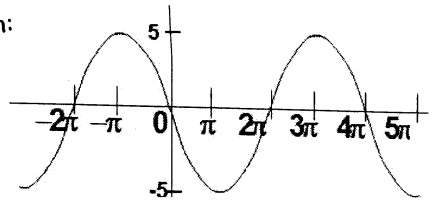
49. Convert $\frac{4\pi}{9}$ to degrees. $\frac{4\pi}{9} \cdot \frac{180^\circ}{\pi} = 80^\circ$

50. Find the following values:

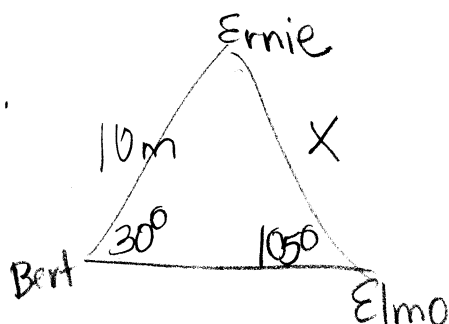
a. $\cos^{-1}\left(\frac{\sqrt{3}}{2}\right)$ $\frac{\pi}{6}$ b. $\sin^{-1}\left(-\frac{1}{2}\right)$ $-\frac{\pi}{6}$ c. $\tan^{-1}(1)$ $\frac{\pi}{4}$

see other pg

51. 3 friends are camping in the woods, Bert, Ernie and Elmo. They each have their own tent, and the tents are set up in a triangle. Bert and Ernie are 10m apart. The angle formed at Bert is 30° . The angle formed at Elmo is 105° . How far apart are Ernie and Elmo?
52. A triangular playground has sides of lengths 475 feet, 595 feet, and 401 feet. What are the measures of the angles between the sides, to the nearest tenth of a degree?
53. The diagonal of a rectangle is 12 cm long and makes an angle of 32° with the longer side. Find the length of the long side of the rectangle.
54. Give the domain, range, amplitude, and period: $g(x) = -2 \cos(x - \pi)$
55. Find an equation:



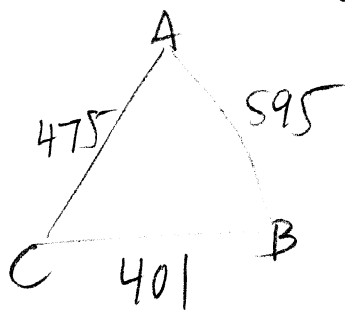
51.



$$\frac{\sin 30^\circ}{X} = \frac{\sin 105^\circ}{10}$$

$$X = \frac{10 \sin 30^\circ}{\sin 105^\circ} = \boxed{5.18 \text{ m}}$$

52.



$$595^2 = 475^2 + 401^2 - 2(475)(401) \cos C$$

$$-32401 = -380950 \cos C$$

$$\bullet 0.850531566 = \cos C$$

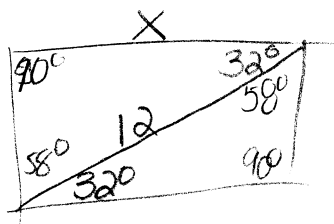
$$C = 85.1^\circ$$

$$\frac{\sin B}{475} = \frac{\sin 85.1^\circ}{595}$$

$$A = 42.2^\circ$$

$$B = 52.7^\circ$$

53.



$$\cos 32^\circ = \frac{X}{12}$$

$$X = 12 \cos 32^\circ = \boxed{10.18 \text{ cm}}$$

$$54. \quad g(x) = -2 \cos(x - \pi)$$

$$D: (-\infty, \infty)$$

$$R: [-2, 2]$$

$$\text{per} = \frac{2\pi}{1} = \boxed{2\pi}$$

55.

$$\text{refl. sin}$$

$$\text{per} = 4\pi$$

$$\text{amp} = 5$$

$$\frac{2\pi}{B} = 4\pi$$

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

$$4\pi B = 2\pi$$

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

$$\boxed{y = -5 \sin\left(\frac{1}{2}x\right)}$$

56. Evaluate the following limits. If the limit does not exist, give the direction (if it has one).

a. $\lim_{x \rightarrow \infty} \frac{-6x+7}{5x+1}$
 $\frac{-6}{5}$

b. $\lim_{x \rightarrow \infty} \frac{x-8}{x^2-3x-2}$
 0

c. $\lim_{x \rightarrow \infty} \frac{2x^2-4x+9}{x}$
 ∞

d. $\lim_{x \rightarrow \infty} 9$
 9

e. $\lim_{x \rightarrow 0} \frac{1}{x^2}$
 ∞

f. $\lim_{x \rightarrow 1} (x^2 - 25)$
 -24

g. $\lim_{x \rightarrow 5} \frac{x-5}{x^2-25}$
 $\lim_{x \rightarrow 5} \frac{1}{x+5} = \frac{1}{10}$

h. $\lim_{x \rightarrow 4} \frac{(2-\sqrt{x})(2+\sqrt{x})}{(4-x)(2+\sqrt{x})}$
 $\lim_{x \rightarrow 4} \frac{1}{2+\sqrt{x}} = \frac{1}{2+\sqrt{4}} = \frac{1}{4}$

57. Refer to the graph to evaluate the following:

a. $\frac{-1}{x \rightarrow -1^+} \lim f(x)$

b. $\frac{3}{x \rightarrow -1^-} \lim f(x)$

c. $\text{DNE} \lim_{x \rightarrow -1} f(x)$

d. $\frac{1}{x \rightarrow 1^+} \lim f(x)$

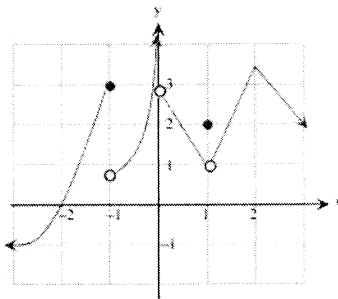
e. $\frac{1}{x \rightarrow 1^-} \lim f(x)$

f. $\frac{1}{x \rightarrow 1} \lim f(x)$

g. $\frac{\sim 3.5}{x \rightarrow 2} \lim f(x)$

h. $\frac{3}{f(-1)}$

i. $\frac{2}{f(1)}$



58. Find the derivative of each function:

a. $y = 8x^2 - 9x + 1$

$y' = 16x - 9$

b. $y = \frac{-4}{\sqrt[3]{x}} = -4x^{-1/3}$ c. find $f''(x)$ if $f(x) = x^{23} - 8x^{20} + 9x$

$y' = -\frac{4}{3} x^{-2/3}$
 $= \frac{-4}{3x^{2/3}}$

$f'(x) = 23x^{22} - 160x^{19} + 9$
 $f''(x) = 506x^{21} - 3040x^{18}$