





81. &+. &',





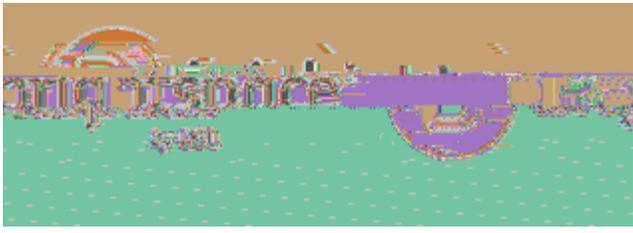












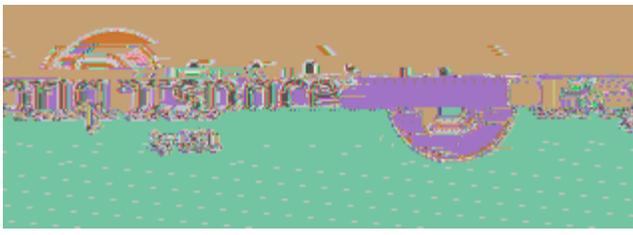
91\*: 2+. &,8%). \$+,, #&1"<,

#DEFGHI !7JKD

(LMMJNO!HP!+QJI RDG

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= '#\$. 2+. &',

= '#\$. 2+. &', >)'#\*',

?%)&,#'='#\$. 2+. &'@,

?%)&,#'+<(+,)'":((1"&+C,#,='#\$. 2+. &'@,

, SKDI GFHI	CFID!' OUD	. HKDG



=CC,\*)&+\$1"#+'&,1,2). )\$+,)' '\$\$. 2+. &,' :>2#' '#1. ,A1BC+'' ,

!

 \*GGFRI MDI KG

\*GGFRI MDI K!(LVMFGGFHI !CHTWDNG . DX!(LVMFGGFHI !CHTWDN

CHTWDN!)NHUDNKF DG . DX!+JKDRHNO

!

(JED

8"+)&+,.) ,)' '\$\$. 2+. &,' :>2#' '#1. ,A1BC+'' ,

\*GGFRI MDI KG

\*GGFRI MDI K!(LVMFGGFHI !CHTWDNG . DX!(LVMFGGFHI !CHTWDN

. JMD

CHTWDN!' OUD %NHLU!GLVMFGGFHI !PHTWDN!

%NHLU!+JKDRHNO

- +JKDRHNO! . DX!+JKDRHNO
- %NJWD!\$KDMY
- . DX!%NJWD!\$KDM
- OLK!OP!
- OLK!OP! 1 JS!) HFI KG!
- (KLWDI KI/!FDX!)NDEFDX!
- , WFK!7FGUTJO!(DKKFI RG
- \*WW!#LVNFZ +NDJKD!#LVNFZ!FI!. DX!; FI WHX
- \$I GKNLZKFHI G
- \*TTHX!LGDNG!KH!JWW!KQFG!PHTWDN!KH!
- KQDFN!D)HNKPHTFH
- \*KKJZODW!CFTDG
- (QHX!(LVMFGGFHI !OUKFHI G!
- (JED



D+&,"+B+)'+,\*1.C#&#1.' ,A1",).,)'#\$ . 2+ . &,' :>2#' '#1. ,A1BC+",

 \*GGFRI MDI KG

\*GGFRI MDI K!(LVMFGGFHI !CHTWDNG!

 ,WFK!(LVMFGGFHI !CHTWDN

#DGKNEZKFHI G!

#DTDJGD!+HI WFKFHI G

• \*KKJZQ!, SFGKFI R

\*KKJZQ

• +NDJKD!JI W!\*KKJZQ  
+HI WFKFHI !7DKJFTG!

+HI WFKFHI !' OUD!  
+NDJKD

\*TT!ZHI WFKFHI G!MLGK!

VD!MDK \* I O!ZHI WFKFHI !MLGK!VD!MDK

(JED!JI W!+THGD

=CC,' (+\*#)B,) \*\*+'',&1,).,)'#\$ . 2+ . &,' :>2#' '#1. ,A1BC+",





(JED!JI W!+THGD

E+1"C+"F,+C#&F,). C,C+B+&+,)' '\$\$. 2+. &,' :>2#''#1. ,\*)&+\$1"#+' ,). C,A1BC+"',

!

!

 \*GGFRI MDI KG

\*GGFRI MDI K!(LVMFGGFHI !CHTWDNG

•

1 HND!\*ZKFHI G

 #DHNWDN

(HNK!ONWDN

(JED

•

 , WFK!

(JED

•

 , WFK! (LVMFGGFHI !CHTWDN

(JED!JI W!+THGD

•

 7DTDKD!

7DTDKD

•

 7DTDKD!CHTWDN

7DTDKD

E+'&1"+,C+B+&+C,)' '\$\$. 2+. &,' :>2#''#1. ,A1BC+"',

 \*GGFRI MDI KG

\*GGFRI MDI K!(LVMFGGFHI !CHTWDNG!

1 HND!\*ZKFHI G!

 , EDI K!-HR

#DGKHND!

D+&, )0)#>#&&<,). C,C: +,C)&+' ,A1",). ,)' '\$\$. 2+. &,' :>2#''#1. ,A1BC+"',

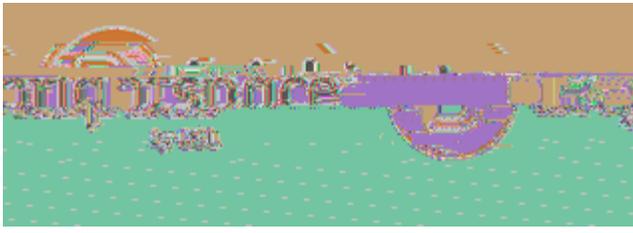
 \*GGFRI MDI KG

\*GGFRI MDI K!(LVMFGGFHI !CHTWDNG!

 , WFK! (LVMFGGFHI !CHTWDN

#DGKNFZKFHI G!





=CC,A++C>)\*J,). C,+0)B: )&#1. ',&1,)'#\$ . 2+. &,' :>2#''#1. ',



= ' ' # \$ . 2 + . & ' , ) . C , K : " . # & # . ,  
=> 1 : & , K : " . # & # . ,

*a*      *b*      *a* <sub>2</sub> <sub>2</sub>      ' L N I F K F I ! \$ I K D R N J K F H I      **B**      *a* <sub>2</sub>      **A**      **F**

/ . ) > b + , K : " . # & # . , A 1 " , ) . , ) ' ' # \$ . 2 + . & , ' : > 2 # ' ' # 1 . , A 1 B C + " ,

- 
- 

W: T4 > NW ) J N K O 4 ' L N I F K F I 4 - ' \$ !

\* G G F R I M D I K G

. D X ! C H T W D N



- $E ab T \quad a a \quad b$

$a \quad a \quad a$

- (LVMFK!CFTDG





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K"1: >B+'%11&#. \$0,P,'++,).,)'#\$\$. 2+. &,' : >2#' '#1. , '%1H#. \$,) . ,#\*1. ,&%)&,' )<'F,Q=. , 1"#\$\$. )B#&<,"+ (1"&,  
\*1: BC,. 1&,>+,\$+. +")&+C,A1",&%#' ,A#B+Q5,

=H)"C' ,

=>1: & , =H)"C' ,



- . DEDN

- CFSDW!WJKD





G#+H,)H)"C',A1",),\*B)' 'B#' & ,

\*XJNWG

+TJGGTFGK!\*XJNWG4

\*TT "JWRDG +DNKFPFZJKDG

+TJGGTFGK

+HLNGD!\*XJNWG





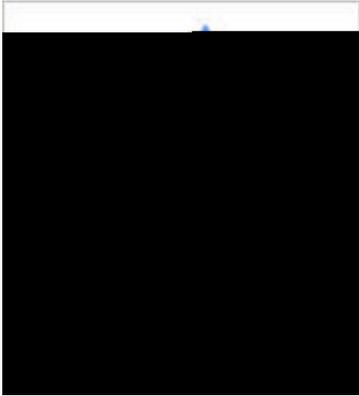


=>1: &,( )" + . &L\*%#BC," +B) &#1. '%#(' ,>+&H++ . , \*12 (+&+ . \* < , '&": \* &: " + , +B+2 + . &' ,

, TDMDI K	) JNDI KG	+OFTWNDI
▲		<ul style="list-style-type: none"> <li>•</li> <li>•</li> </ul>
▲	<ul style="list-style-type: none"> <li>•</li> <li>•</li> </ul>	<ul style="list-style-type: none"> <li>•</li> <li>•</li> </ul>
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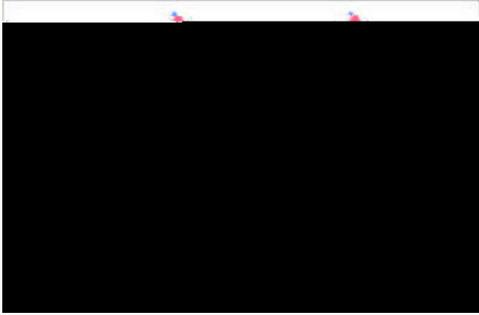


=>1: &, . +'&+C,\*12 (+&+. \*<,'&": \*&: "+',





=>1: &,10+"b) ((#. \$,\*12 (+&+. \*<,'&": \*&: "+',



DH#&\*%,<1: ",0#H,#. ,\*12 (+&+. \*#+' ,

! +HMUDKDI ZFDG

+HMUDKDI ZO!&HMD











#DGLIKG!

\*GGDGG!

(JED

/.)>b+,b+)".#. \$,1>U+\*&#0+,\*12 (b+&#1. ,: '#. \$,W: #X,1",,\$")C+,#&+2,)\*&#0#&#+',H#&%,): &12)&#\*,)'+' '2+. & ,

■+HMUDKDI ZFDG

+HMUDKDI ZO!&HMD!

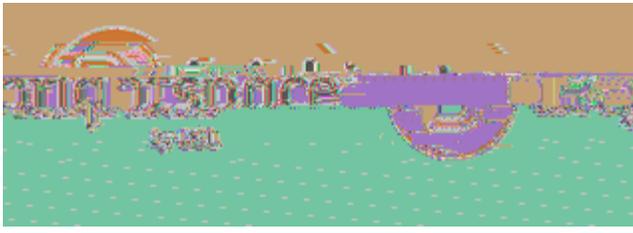
■ (KNLZKLND

, WFK! (KNLZKLND \$I ZHNUHNJKD!\*ZKFEKFDG

\*GGDGG!OVaDZKFED

\*GGDGGMDI K!' OUD





8"+)&#. \$,) . C,+C#&#. \$,\*12 (+&+. \*#+ 'F,B+)" . #. \$,1>U+ \*&#O+'F,) . C,  
) \*&#O#&#+ ' ,  
S. C+' '&). C#. \$,\*12 (+&+. \*<,'&)&: ','+&&#. \$' ,

' QD!ZHMUDKDI ZO

7NJK!

\$I !#DEFDX!

\*UUNHEDW

\*NZQFEDW!



+HMUDKDI ZO!&HMD

. DX!

 +HMUDKDI ZO

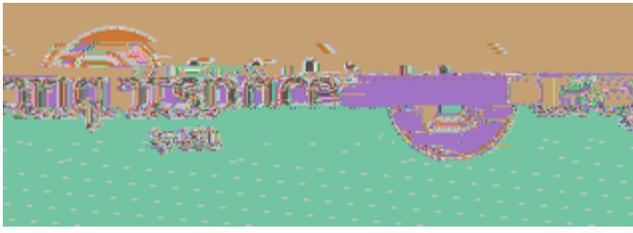
. DX!+HMUDKDI ZO

, EJTLJKFHI !(DKKFI RG!



9+b+&&+),\*12(+&&+.\*<,





S. C+""&). C#. \$,\*12(+&+. \*<,'&": \*&: "+',). C,)''1\*#)&#1. ',  
=' '1\*#)&+.), \*12(+&+. \*<,'&": \*&: "+, +B+2+. &, H#&%,). 1&%+", +M# '&#. \$, +B+2+. &,

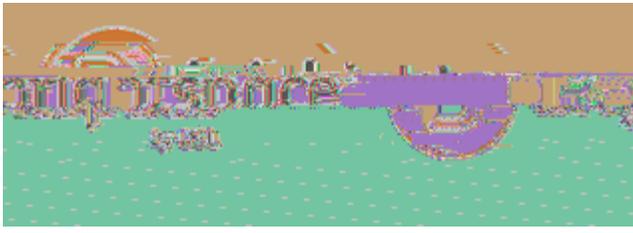
 +HMUDKDI ZFDG

+HMUDKDI ZO!&HMD

 (KNLZKLND

, WFK! (KNLZKLND

- \*WW!) JNDI K
- \*WW!+QFTW



E+210+,)'1\*#)&#1.' ,>+&H++ . ,),B+)". #. \$,1>0+\*#0+,). C,) . ,)\*#0#&<,A"12,). 1&#+",&11B,)"+),

- \*GGFR I MDI K!GLVMFGGFHI !PHTWDNG  
✏️ , WFK!CHTWDN
- 1 JI JRD! ?LFddDG!



!' QFG!HNR!L I FK!

- 
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- 

\*TT!WDGZDI WJ I KG!

\*TT!WDGZDI WJ I KG!HP!KOU!

\$I GDNK

\*ZQFDEDMDI K +NFKDNEJ! !

(JED

=>1: &,\*12 (+&+. \*<,'0+"#1. ',

#DJWO!PHN!/DNGFHI FI R!

#DJWO!PHN!/DNGFHI FI R

W: T4' HHTG4+HMUDKDI ZFDG4(DKKFI RG4(QHX/DNGFHI . LMVDN

G#+H,\*12 (+&+. \*<,'&": \*&:"+',": B&',

✔ \*ZQFDEDW!

👤 ,SUJI W!\*ZKFEKO!

🖤+HMUDKDI ZFDG

+HMUDKDI ZO!&HMD!

🚩 (KNLZKLND

(KNLZKLND!(LMMJNO!

👉 /FDX!#DGLTKG

(DJNZQ!CHN



NO+""#C+,),: '+ "T',"+' : B&,






Y")C#. \$, '\*%+2+',

%NJWD!GZQDMD	, SJMUTD









%NJWFI R!

1 JSFMLM!)HFI KG!

- , WFKHN!

, WFK!8GF! R!KQD!CHNMLTJ!, WFKHN  
\$! GDNK

CHNMLTJ!

- , SZDDW

+JI!

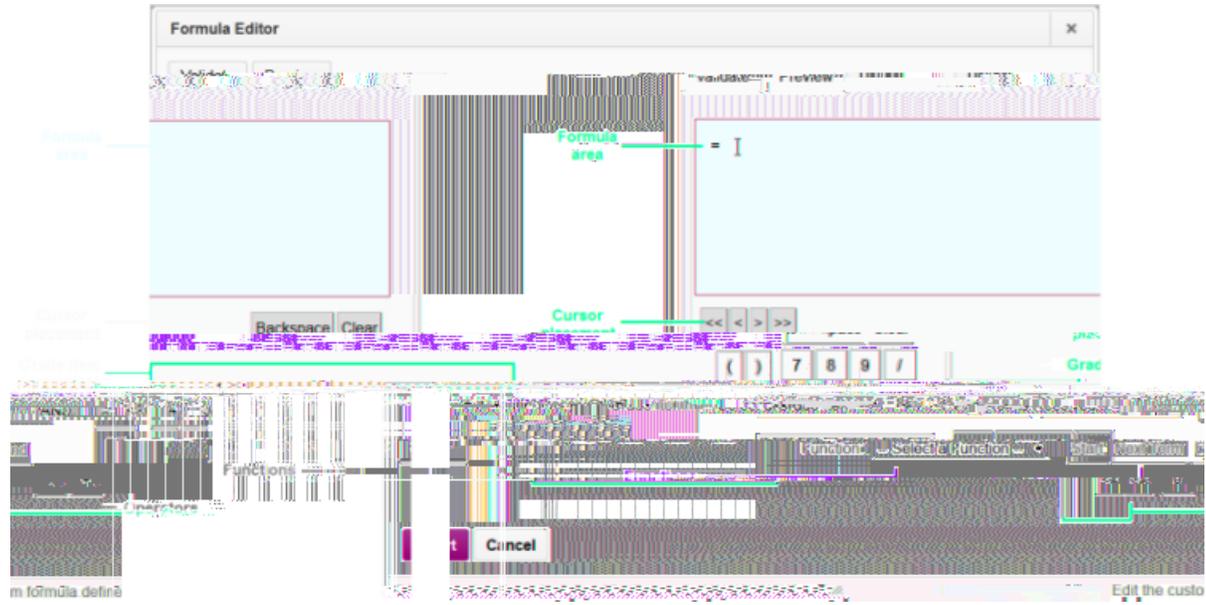
- %NJWD!(ZQDMD

\*WW!#LVNEZ

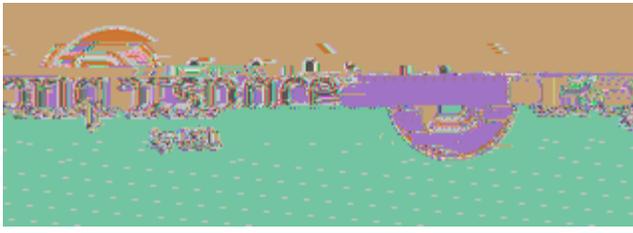
7FGUTJO!OUKFHI G



=>1: &,A1"2: B),\$" )C+,##+2',



+HMUHI DI K	7DGZNFUKFH I



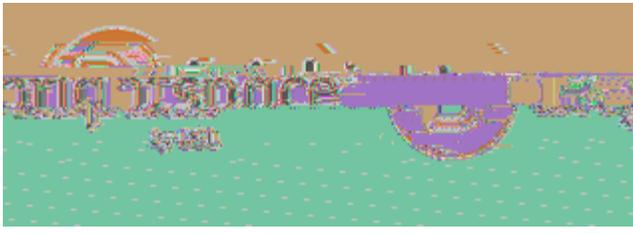
\$KDM

%NJWD!

!

%NJWD!\$KDM!/JTLD!

- ) HFI KG!#DZDFEDW
- 1 JS!) HFI KG
  
- ) DNZDI K! !



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I 1" 2: 8), /C#&1", 0)B#C)&#1. , +""1"' ,

, NNHN	7DGZNFUKFH I	, SJMUTDG
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%NJWFI R!

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"HI LG!

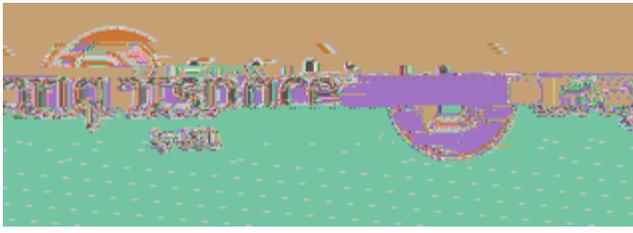
•

%NJWD!(ZQDMD

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\*WW!#LVNEZ

7FGUTJO!OUKFHI G



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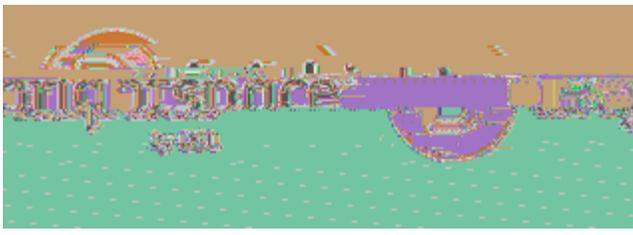
(JED!JI W!+THGD

E+B+)'+,A#. )B,\$")C+',

👉 %NJWD!\*TT

👉 %NJWD!\*TT





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R) . : ) BB< , " + \* ) B \* : B ) & + , & % + , A # . ) B , \$ " ) C + ,  
 \* L K H M J K F Z J T T O ! [ D D U ! P F I J T ! R N J W D G ! L U W J K D W !

 %NJVWDG

- 
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+ J T Z L T J K D W ! % N J W D C F I J T ! % N J W D # D Z J T Z L T J K D ! K O D ! C F I J T !

C F I J T ! + J T Z L T J K D W ! % N J W D % N J W D ! \* T T C F I J T ! % N J W D  
 C F I J T ! % N J W D ! # D Z J T Z L T J K D ! \* T T

/ . & + " , ) . , ) C U : ' & + C , A # . ) B , \$ " ) C + ,

 %NJVWDG

1 J I J R D ! % N J W D ! C F I J T ! \* W a L G K D W ! % N J W D , I K D N ! % N J W D  
 C F I J T ! \* W a L G K D W ! % N J W D ! # D T D J G D ! C F I J T ! \* W a L G K D W ! % N J W D

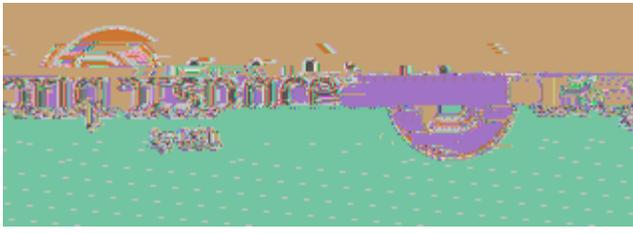
( J E D

8 ) B \* : B ) & + , A # . ) B , \$ " ) C + ' , A 1 " , ) , ' # . \$ B + , : ' + " ,

 %NJVWDG

, I K D N ! % N J W D G

+ J T Z L T J K D W ! % N J W D + J T Z L T J K D C F I J T ! + J T Z L T J K D ! % N J W D # D Z J T Z L T J K D ! K O D ! C F I J T !



D\*+. )"#10,l#. )B,\* )B\*: B)&+C,\$")C+,: '#. \$,V1#. &', '<'&+2,

)NHADZK!2 )NHADZK!: )NHADZK!>



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%NJWD!FKDM	+JTZLTJKFHI
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P2 (1"&W: +'&#1. ',#.&1,\: +'&#1. , -#>)"<,A"12,) ,8DG,A#B+,

+(/!(JMUTD!CFD

\$MUHnk

!\$MUHnk!(HLNZD

CNHM!J!7: -!' DSK!CHNMJK!CFD

"NHXGD!

OUdI! (JED

P2 (1"&W: +'&#1. ',#.&1,\: +'&#1. , -#>)"<,A"12,) ,B+) ". #. \$,1>U+\*&,"+(1'&#1"< ,

\$MUHnk

\$MUHnk!(HLNZD

-DJNI FI R!#DUHGFKHNO!f-O#g

\*Ww!-DJNI FI R!OVaDZK

(DIDZK

(JED

8"+)&#. \$, \: +'&#1. , -#>)"<,W: +'&#1. ',

K<(+',1A,W: +'&#1. ',

•



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8"+)&+,&": +,1",A)B'+,W: +'&#1. ',





%DI DNJT!

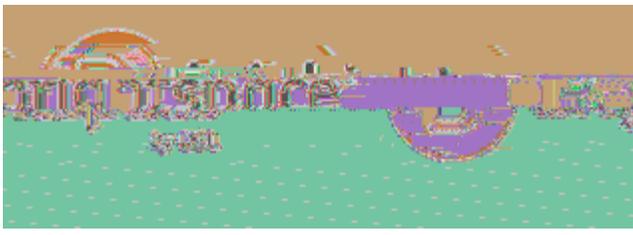
OUKFHI G!

8"+)&+,'%1"&,).'H+",W: +'&#1.' ,



•

+



8"+)&+,2)&\*%#. \$,W: +'&#1. ',

. DX!

1 JKZQFI RI?LDGKFHI !f1 \*'g

%DI DNJT!

+QHFZDG!

•

• /JTLD!

•

+ \*WW!+QHFZD

1 JKZQDG!

• /JTLD!

•

+ \*WW!1 JKZQ

•

+HNNDZK!+QHFZD

)NDEFDX

8"+)&+,1"C+"#. \$,W: +'&#1. ',

. DX!

ONWDFI RI?LDGKFHI !fO#7g

%DI DNJT!

OUKFHI G!

•

• /JTLD!

+ \*WW!\$KDM

• +HNNDZK!ONWDFI

)NDEFDX

S. C+"&). C#. \$,\$")C#. \$,1(&#1. ',A1",2)&\*%#. \$,). C,1"C+"#. \$,W: +'&#1. ',

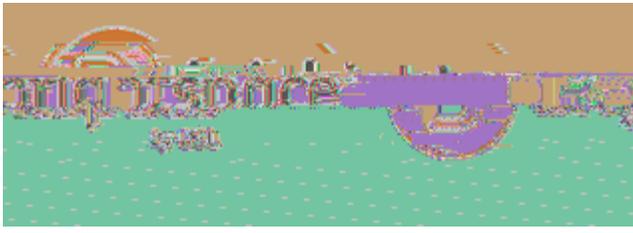
• ,cLJTTO!XDFRQKDW! !

• \*TT!HN!I HKQFI R



- #FRQK!MFI LG!XNHI R

8"+)&+,)"#&%2+&#\*,W: +'&#1. ',



•

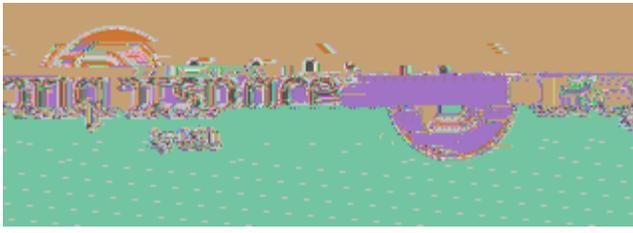
(KDU

)NDEFDX

1 FI! 1 JS!

S. C+"&). C#. \$,)"#&%2+&#\*,). C,'#\$ . #A#\*). &,A#\$: "+',W: +'&#1. , \*12(1. +. &',





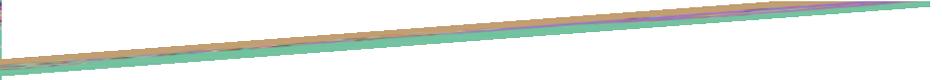
S. C+" '&). C#. \$,! "#\$%&' () \*+,-+)" . #. \$,/. 0#"1. 2+. &,"1: . C#. \$," : B+',

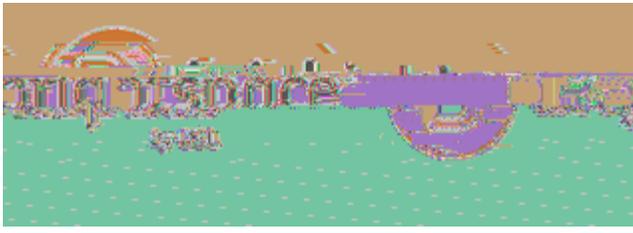
, EJTLJKFHI !OUKFHI G

- +JGD!\$! GD! GKFED
- +JGD!(DI GKFED
- #DRLTJN!, SUNDGGFHI



8"+)&+,&+M&,f. A1"2)&#1. ,





+QJNJZKDN

7DGZNFUKFH I

, SJMUTD





+QJNJZKDN

7DGZNFUKHI

, SJMUTD







+QJNJZKDN 7DGZNFUKHI

,SJMUTD



- ,WFK!?LDGKFHI !

)NDEFDX

7HI D

E+1"C+",W: +'&#1. ',1",'+\*&#1. ',#,.\: +'&#1. ,-#>)"<,

📁 ONWDN

ONWDN!

⬆️ 1 HED!8U! ⬇️ 1 HED!7HXI

V: >B#'% ,W: +'&#1. ',) . C, '+\*&#1. ',&1,) ,b+)" . #. \$, "+(1'##1"<,

📁 )LVTFGQ!KHI-O#

- )FZ[!J!#DUHGFKHNO

!OEDN×NFKD!JI !DSFGKFI RIHVαDZK

(DJNZQ

(DTDZK

(QJNFI RIJI W!)LVTFGQFI R!OUKFHI G

-



\: #XX+',

\: #XX+',>)'#\*',

/M(1"&,%+,+0+. &,B1\$,1A,)BB,W: #X,)&&+2 (&',

%NJWD! ?Lfd , SUHnk!, EDI KI-HRG

(JED

E+' +&,W: #X,)&&+2 (&',A1",B+)". +'',

? ?LfdDG

1 JI JRD! ?LfdDG!

%NJWD



#DGDk!

V"+0+. &, \*%+)&#. \$,#. ,W: #XX+',

- , WFK! ?Lfd! OUKFHI JTI!\*WEJ I ZDW!)NHUDNKFDG! 7FGJVTD!NFRQK!ZTFZ [
- , WFK! ?Lfd OUKFHI JTI!\*WEJ I ZDW!)NHUDNKFDG! 7FGJVTD!\$I GKJ I KI 1 DGGJRDG!J I W!JTDNKG
- 

G#+H,&%+,+0+. &,B1\$,1A,) , '#. \$B+,W: #X,)&&+2 (& ,





=CC,'(+\*#)B,)\*\*\*+'',&1,) ,W: #X,&%)&,"+W: #"+',E+' (1. C: ',-1\*J91H.,!"1H'+",

1 JI JRD!?LfddDG

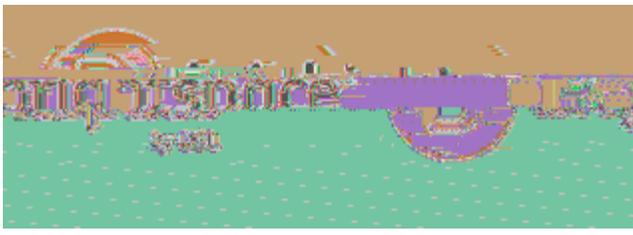


#DGKNFZKFHI G! (DZLNFKO!OUKFHI G !#DGUI WLGI-HZ[7HXI!"NHXGDN

- #DcLFNDW!KH!KJ[D!KQFG!cLfD
- #DcLFNDW!KH!EFDX!cLfD!PDDWVJZ[!JI WINDGLTKG

\*WW!8GDNG!KH!(UDZFJT!\*ZZDGG

\*WW!(UDZFJT!\*ZZDGG!KH!?LfD! -HZ[7HXI!"NHXGDNW . HK!NDcLFNDW!KH!KJ[D!KQFG!cLfD



(JED

#DGKNFZKFHIG

- \*TTHX!GDTDZKDW!LGDNG!GUDZFJT!JZZDGG!KH!J!cLfD



8"+)&+,),W: #X,"+(1"&,

 ?LFddDG

1 JI JRD!?LFddDG

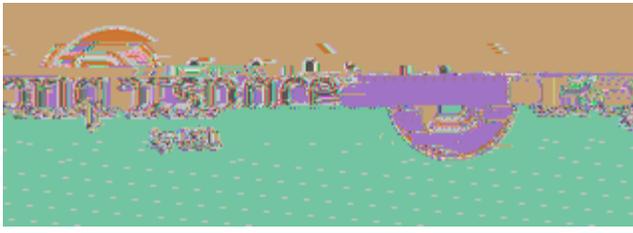
#DUHNG!(DKLU \*WW!#DUHnk

#DUHnk!. JMD

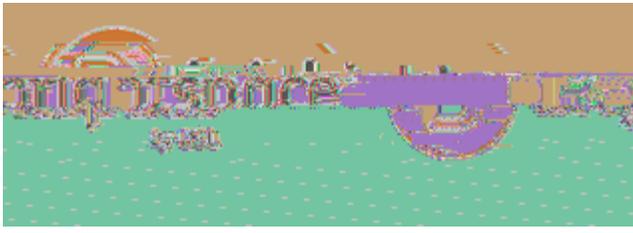
#DUHnk!' OUD

(JED

 , WFK



=>1: &,W: #X,"+(1"&',



Y#0+,+)\*%,B+) ". +",),"). C12,'+&,1A,W: #X,W: +'&#1. ',

 ?LfddDG

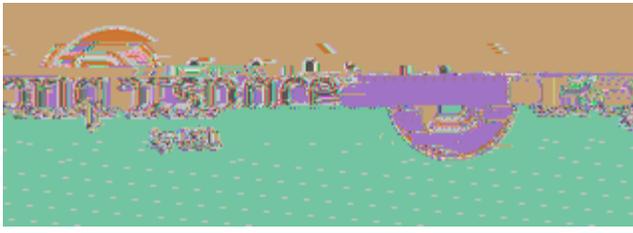
1 JI JRD!?LfddDG

\*WWk, WFK!?LDGKFHI G

. DX! #JI WHM!(DZKFHI

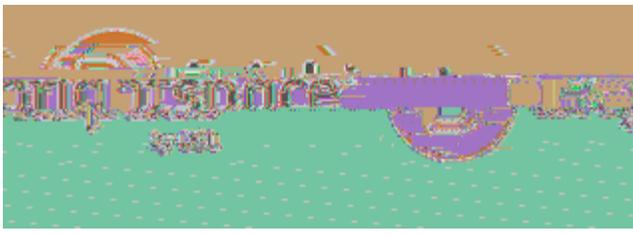
%DI DNJT!

7FGUTJO!OUKFHI G



\: #XX+' ,) . C, \: +'&#1. , -#>)" "< ,

81. '#C+)"&#1. ' ,)"1: . C, W: #XX+' , H#&&% ,)' '1\*#)&#1. ' ,&1, \: +'&#1. , -#>)" "< ,



81 (<,) ,W: #X,H#&&%,\,: +' &#1. ,-#>)" "<,)'' 1\*#)&#1. ',&1,) . 1&%+" ,1"\$ ,: . #& ,

+HLNGD!\*WMFI \$MUHNkk, SUHNkk+HUO!

+HMHUHI DI KG

+HUO!+HMHUHI DI KG!PNHM!JI HKODN!ONR!8 I FK

(DJNZQ!PHN!HPPDNFI R

\*WW!(DTDZKDW! (DTDZK!+HMHUHI DI KG

?LDGKFHI !-FVNJNO! ?LfddDG

- +HUO!JTI!FKDMG +HI KFI LD
- (DTDZK!FI WFEFWLJT!FKDMG!KH!ZHUO +HI KFI LD (DTDZK!\$KDMG!  
KH!+HUO +HI KFI LD
- CFI FGQ

E: >"#\*" ,

E: >"#\*" ,>)'#\*" ,

?%+" ,\*) . ,<1: ,: '+ ,) ,": >"#\*@ ,

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K<(+',1A," : >"#\*" ,

- &HTFGKFZ!#LVNFZG

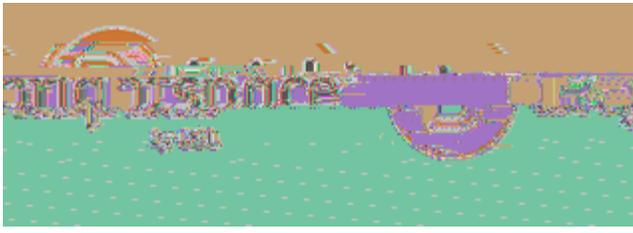


- \*I JTOKFZ!#LVNFZG !





•



• (JED) . DX!

• (JED) \$MUHNK





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- 

### Question 1

Why are you taking this course?

- To satisfy a prerequisite.
- To prepare myself for further studies in Astronomy.
- For interest.
- Other



+HTTDZK!FI PHNMJT!ZHLNGD!DEJTLJKFHI G!HN!MFW^ODJN!NDEFDXG

- 
- 
-











D+&,) ,C)&+,"). \$+,A1",),': "0+< ,

 (LNEDOG

1 JI JRD!(LNEDOG

#DGKNFZKFHI G

7JKDG!JI W!#DGKNFZKFHI G

&JG!(KJNK!7JKD

&JG!, I W!7JKD

\*ZKFED

(KJCLG

7FGUTJO!FI!

+JTDI WJN

(JED!JI W!+THGD

=. 1. <21: ', ()"&#\*#()&#1. ,# ,),': "0+< ,

/. ': "+,) . 1. <21: ', ': "0+< , ()"&#\*#()&#1. ,

 (LNEDOG

1 JI JRD!(LNEDOG

%DI DNJT

MJ[D!NDGLTKG!JI HI OMHLG

D+&&#. \$,': "0+< ,"+'&"#\*&#1. ' ,

#DGKNFZKFHI G



(LNEDOG

#DGKNFZKFH I G

8GDN!#DGUIH GDG

\*KKDMUKG!\*TTHXDW

- 8 I TFMFKDW
- (FI RTD!JKKDMUK!KQJK!FG!DWFKJVTD
- -FMFKDW

8"+)&+, '(+\*#)B,) \*\*+'', &1,), ': "0+< ,



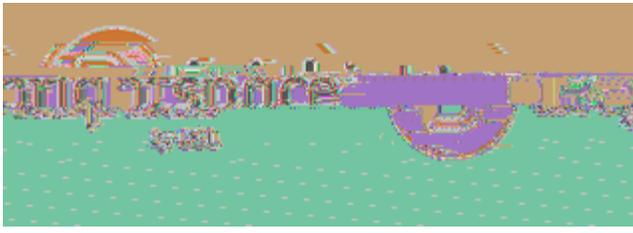
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#DGKNFZKFH I G

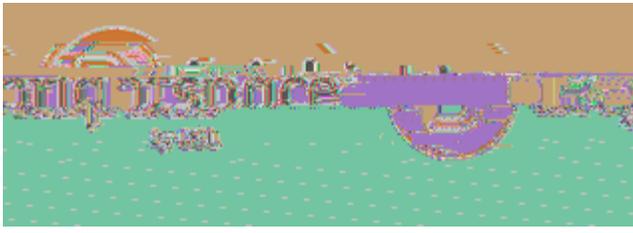
- \*TTHX!GDTDZKDW!LGDNG!GUDZFJT!JZZDGG!KH!KQFG!GLNEDO
- \*TTHX!HI TO!LGDNG!XFKQ!GUDZFJT!JZZDGG!KH!GDD!  
KQFG!GLNEDO
- \*WW!8GDNG!KH!(UDZFJT!\*ZZDGG

\*WW!(UDZFJT!\*ZZDGG

K")\*J, ': "0+< , ("1\$"+'', ). C, "+' : B&' ,



D+&, : (, ' : "0+<, "+(1"&',

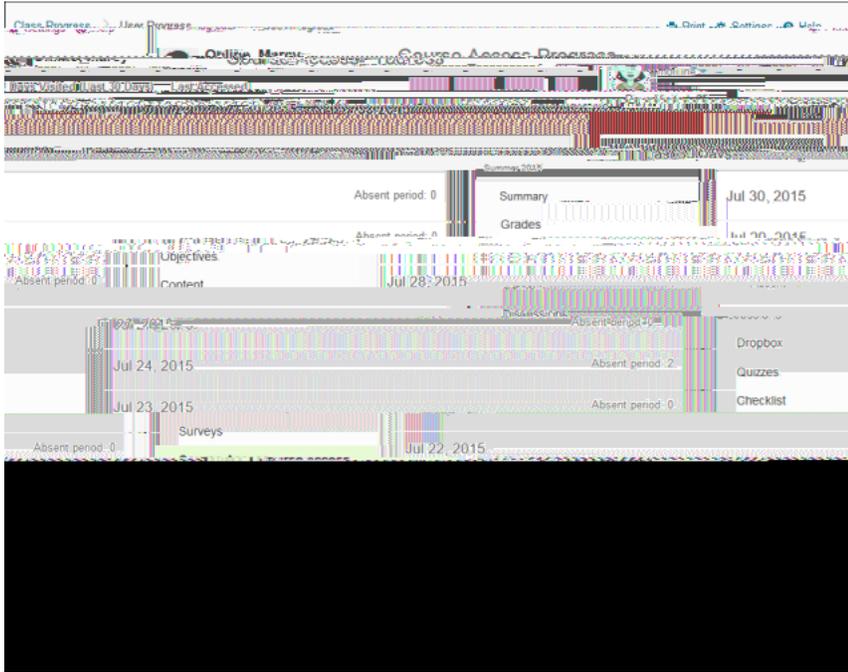
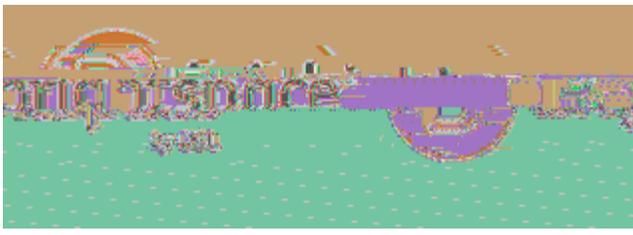


] 1&#A<, () "&#\*# (). &' ,1A,) . ,)0)#B) >B+, ' : "0+< ,

- , WFK!(LNEDO \$I EFKD!) JNKZFUJI KG



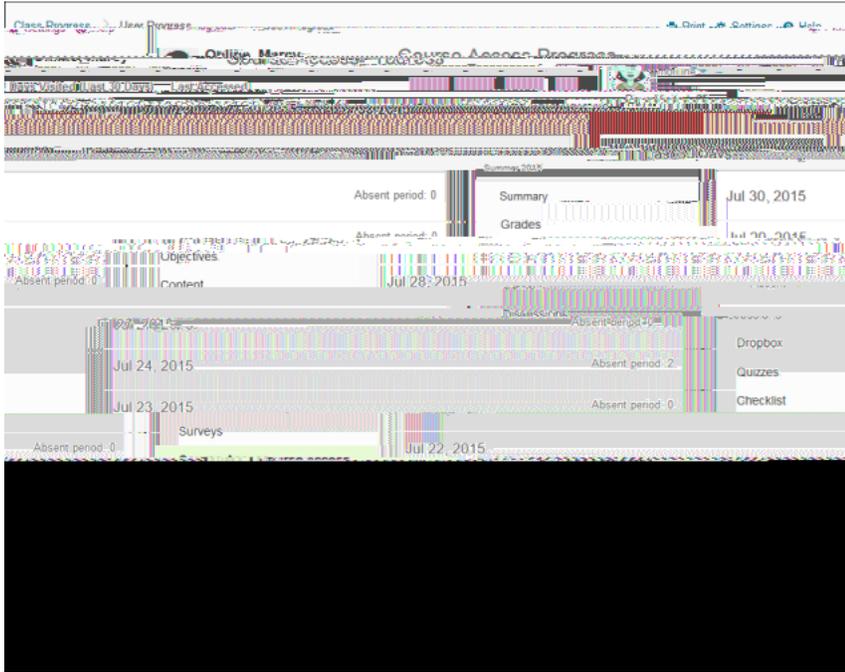




S' + ",V"1\$" + ' ' ,10+ "0# + H,

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8%). \$+,S'+",V"1\$"+''+','+&&#. \$',

+HI ZDNI G \*K!#FG[

8GDNI!)NHRNDGG

(DKKEI RG

OI!' NJZ[ (HMD!





+TJGG!)NHRNDGG!

 (DKKFI RG

 #DUTJZD

(DTDZK!)NHRNDGG!\$I WFZJKHN

 1 HED!8U!  1 HED!7HXI



=>1: &, 9^-,

